Exhibit E1
Public Redacted Version

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UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

IN RE GOOGLE PLAY CONSUMER ANTITRUST LITIGATION

THIS DOCUMENT RELATES TO:

In re Google Play Consumer Antitrust Litigation, Case No. 3:20-cv-05761-JD

State of Utah et al. v. Google LLC et al., Case No. 3:21-cv-05227-JD

Case No. 3:21-md-02981-JD

DEFENDANTS' NOTICE OF MOTION AND MOTION TO EXCLUDE MERITS OPINIONS OF DR. HAL J. SINGER; MEMORANDUM AND POINTS OF AUTHORITIES IN SUPPORT OF THEREOF

[PROVISIONALLY UNDER SEAL]

Judge: Hon. James Donato
Courtroom: 11, 19th Floor, 450 Golden Gate Ave, San Francisco, California, 94102

NOTICE OF MOTION

TO ALL PARTIES AND THEIR COUNSEL OF RECORD:

PLEASE TAKE NOTICE THAT on a date to be set by the Court, in Courtroom 11, 19th Floor, 450 Golden Gate Avenue, San Francisco, California, 94102, before the Honorable James Donato, the undersigned Defendants ("Defendants"), will and hereby do move the Court for an order excluding the testimony of Consumer Plaintiffs' proffered expert Hal Singer, on the ground that testimony on the referenced subjects is not expert testimony within the scope of Federal Rule of Evidence 702. This motion is based upon this Notice of Motion, the attached Memorandum of Points and Authorities, the concurrently-filed declaration of Justin P. Raphael, the attachments to that declaration, the concurrently filed Proposed Order, the pleadings and records on file in this action, and upon any additional evidence and argument that may be presented before or at the hearing of this motion.

Respectfully submitted,

Dated: April 20, 2023

By: /s/ *Justin P. Raphael*
Justin P. Raphael

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ISSUE TO BE DECIDED

Whether the Court should exclude all testimony based on the injury and damage models of Plaintiffs' expert Dr. Hal J. Singer as unreliable under Rule 702 of the Federal Rules of Evidence and *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

INTRODUCTION

Both Consumer Plaintiffs and Plaintiff States seek to prove injury and damages based on calculations performed by Dr. Hal J. Singer. Google recognizes that the Court denied its motion to exclude Dr. Singer's testimony at class certification, which is now the subject of an appeal pending before the Ninth Circuit. *Mary Carr, et al v. Google LLC, et al*, No. 22-80140 (9th Cir.), Dkt. No. 10 (Feb. 27, 2023). However, Google files this motion to exclude Dr. Singer's models on the merits for several reasons. *First*, Dr. Singer has offered opinions based on models that this Court did not rely upon in certifying a class; the Court's order "leaves for another day the question of whether it might be presented to a jury." *In re Google Play Store Antitrust Litig.*, 2022 WL 17252587, at *13 (N.D. Cal. Nov. 28, 2022). *Second*, as to the formula that this Court did address on class certification, the Court has advised the parties that its ruling on class certification does not bind it on the merits. *Id.* at *4. Google therefore must preserve its position and create a record, particularly where Plaintiff States, who were not parties to the class certification proceedings, now seek to rely on Dr. Singer's models. *Third*, discovery on the merits has provided additional proof of the fundamental flaws in Dr. Singer's injury and damage models.

Dr. Singer offers six different models related to injury and damages—a smorgasbord of theories that are in tension with one another.[1] Broadly, those models estimate two kinds of alleged injuries: (1) passed-through overcharges and (2) artificially low Play Point subsidies.

Pass-Through. Dr. Singer's overcharge theory formed the basis for this Court's class certification decision: According to Dr. Singer, absent the challenged conduct, Google allegedly would have charged developers lower service fees for the use of the Google Play store, and

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[1] He also advances a model based on a combination of two different models. *See* Declaration of Justin Raphael ("Raphael Decl.") Ex. 1, Singer Rep. ¶ 441. For a brief description, *see* Ex. 2, Leonard Rep. ¶¶ 55–61.

developers in turn allegedly would have reduced the prices of apps, subscriptions and in-app purchases—*i.e.*, developers would have "passed through" lower service fees. Importantly, this pass-through calculation is not merely an input to a model. Pass-through is determinative of the State and Consumer Plaintiffs' main theories of injury and overcharge damages. Merits discovery has confirmed the defects in the formula that Dr. Singer used to calculate pass-through.

First, a crucial assumption concededly is not met here. Dr. Singer's formula for calculating damages and injury is derived from a logit model of user demand. If logit is not a reliable model of user demand, then Dr. Singer's formula derived from logit is not reliable. Dr. Singer conceded that a model of logit demand assumes that all of the products being studied are substitutes in proportion to their shares. However, the Play store app categories Dr. Singer uses for his logit model of demand do not satisfy this assumption because there is no dispute that many of the apps in each category are not substitutes, let alone substitutes in proportion to their shares.

Second, Dr. Singer still fails to account for focal point pricing. Courts have recognized that companies that use focal point pricing may not reduce prices if they face lower costs. Indeed, the States' own economist conceded that focal point pricing means that "some firms would not change price in response to a change in the commission rate." Ex. 3, Rysman Dep. at 62:16-23. Dr. Singer's failure to account for this reason why developers would not pass through lower service fees means his pass-through formula cannot reliably estimate injury or damages.

Third, Dr. Singer's formula cannot reliably estimate pass-through injury or damages because it does not account for a developer's marginal costs other than the service fee. Dr. Singer concedes that pass-through of a service fee will be proportional to the developer's other marginal costs—the lower those other costs, the lower the pass-through and the lower the damages. However, Dr. Singer has not estimated any developer's marginal costs other than service fees. He thus has no way of knowing whether his pass-through formula over- or under-estimates damages.

Fourth, Dr. Singer continues to ignore data showing that virtually no developers reduced prices when Google reduced service fees in the real world, *i.e.*, there was virtually no pass-through. Instead, he relies on a formula that mathematically guarantees pass-through for every developer. A formula that guarantees injury is not a reliable model of whether injury occurred.

Subsidy Models. As an alternative to his pass-through theory, Dr. Singer offers a subsidy theory: absent the challenged conduct, Google supposedly would have offered consumers more Play Points that can be used to make purchases in the Google Play store. The Court found that "Dr. Singer's analysis stumbles a bit on this point," 2022 WL 17252587, at *13, and did not rely on Dr. Singer's Play Points theory in certifying a class. For that reason alone, Dr. Singer should not be able to testify based on a Play Points model on behalf of the Consumer Plaintiff class. *See Comcast Corp. v. Behrend*, 569 U.S. 27, 35 (2013) ("a model purporting to serve as evidence of damages in this class action must measure only those damages attributable to" the "theory of antitrust impact accepted for class-action treatment by the District Court."). Indeed, Dr. Singer testified at deposition that both his subsidy models are aggregate damages models.

Regardless, as to both the Consumer and State Plaintiffs, Dr. Singer's Play Point subsidy models are not reliable. One subsidy model calculates the amount of Play Points Google would have offered in the but-for world. This model is not reliable. *First*, although most users of the Play store did not sign up for the Play Points program in the actual world and were not damaged, Dr. Singer predicts injury and calculates damages for all users of the Play store without any basis to opine that *all* users of the Play store would have even signed up for Play Points. *Second*, Dr. Singer's model relies on the assumption that the but-for world for smartphone app transactions would resemble the long-distance telephone market in the 1980s.

Dr. Singer's other subsidy model is an entirely new model that he did not offer at the class certification stage. It uses the Amazon Coins program as a benchmark for the Play Points Google would have offered in a but-for world. This Amazon Coins model is flawed because it predicts injury and damages for all users without any evidence that all users would have signed up for Play Points. In addition, the Amazon Coins program is an entirely arbitrary benchmark.

BACKGROUND

Pass-Through. Users buy apps, subscriptions and in-app purchases of digital content ("IAPs") at prices set by developers. Ex. 1, Singer Rep. ¶ 339. Users do not pay fees to use the Google Play store, and only the small fraction of developers that sell digital goods in their apps pay Google service fees to do so. Thus, users could have paid more as a result of the challenged

conduct only if (1) developers would have paid Google lower service fees and (2) those developers would have passed through the developers' savings to users by setting lower prices for apps, subscriptions and IAPs. Ex. 4, Singer Merits Dep. at 55:24-57:4. Dr. Singer calculates the extent of any injury—i.e., damages—as the difference between the prices users paid in the actual world and the prices they would have paid in a but-for world of lower developer service fees.

Dr. Singer uses a formula based on logit demand that he put forward at the class certification stage. In that formula, pass-through damages depend on which app category in the Google Play store a developer chooses to list its app: the pass-through rate is simply 1 minus an app's share of its category in the Play store. Ex. 4, Singer Merits Dep. at 73:7-14. For example, if the Rosetta Stone app for learning a new language accounted for 5% of transactions in the "Education" category (which includes apps for "exam preparation, study-aids, vocabulary, educational games, language learning, and more," Ex. 2, Leonard Rep. ¶ 66), Dr. Singer predicts that Rosetta Stone would pass through 95% of any service fee savings.

Dr. Singer continues to ignore data regarding whether developers reduced their prices when Google actually reduced service fees in the real world. At the hot tub proceeding—based on a single SKU from a single developer—Dr. Singer tried to suggest to the Court that Google's expert's analysis was flawed because it did not account for the possibility that developers could have reduced prices by introducing new SKUs. Ex. 5, MDL Dkt. 302, Expert Proceeding Tr. ("Tr. of Hr'g, July 19, 2022"), at 72:4–77:16 (July 19, 2022). Discovery has revealed that effort as pure misdirection. Google's expert, Dr. Greg Leonard, has conducted multiple analyses of six different data sets of IAPs at the SKU level, covering hundreds of products. Every cut of the data found that, on average, the apps increased their prices in the year following the service fee change, and that a minority of apps in any group offered customers a reduced price. Ex. 2, Leonard Rep. ¶¶ 39, 40. Dr. Leonard's analysis found that, at most, developers pass through only 3% of reduced service fees on a weighted average basis—[redacted] for IAPs (the vast majority of transactions), [redacted] for paid downloads, and [redacted] for subscriptions. *Id.* ¶ 51 and Table 8. Dr. Singer *still* has not conducted any statistical analysis of his own.

Play Points. Dr. Singer also estimates injury and damages by calculating the Play Points that Google supposedly would have offered users in the but-for world. Users have to "opt in to Google Play Points," Ex. 4, Singer Merits Dep. at 162:17-19; Ex. 1; Singer Rep. ¶ 373, and more than two-thirds of users did not do so in the actual world. Ex. 4, Merits Singer Dep. at 162:20-163:4. Those users who do sign up earn Points for their purchases in the Play store. *Id*. at 183:10-13. Dr. Singer has not analyzed how an increase in the value of Play Points would affect demand for the Play Points program, Ex. 4, Singer Merits Dep. at 167:11-25, 168:19-170:12, and disclaimed any opinion about whether all users of Play Points would have signed up in the but-for world. *Id.* at 165:14-167:10. He nevertheless predicts injury and calculates damages for *all* users if Google offered more valuable Play Points.

Amazon Coins. Dr. Singer also estimates injury and damages by using the Amazon Coins program in the Amazon Appstore as a benchmark for the Play Point subsidies that Google supposedly would have offered consumers. *See* Ex. 1, Singer Rep. ¶ 420. Dr. Singer does so even though Amazon Coins differ from Play Points in several important ways. *See* Ex. 2, Leonard Rep. ¶ 111. For example, while users earn Play Points for their purchases in apps downloaded from Play, users must buy Amazon Coins separately and then use them to make purchases in the Amazon Appstore. Ex. 4, Singer Merits Dep. at 183:10-16. Further, while users can use Play Points to buy apps, subscriptions or IAPs, users cannot use Amazon Coins to buy subscriptions. *cf.* Ex. 6, Singer Rebuttal Rep. Errata ¶ 55. Dr. Singer's estimate of damages using Amazon Coins as a benchmark is 276% higher than Dr. Singer's other estimate of Play-Points damages. *See* Ex. 2, Leonard Rep. ¶ 110. Dr. Singer could not say which of these widely divergent estimates was more reliable. Ex. 4, Singer Merits Dep. at 179:10-180:10.

LEGAL STANDARD

Under Rule of Evidence 702, this court acts as a "gatekeeper" to ensure that expert testimony is reliable. *Ellis v. Costco Wholesale Corp.*, 657 F.3d 970, 982 (9th Cir. 2011). Plaintiffs have the burden to prove that Dr. Singer's testimony is "the product of reliable principles and methods." Fed. R. Evid. 702(c). *See Bourjaily v. United States*, 483 U.S. 171, 175–76 (1987). To meet their burden, Plaintiffs must show that Dr. Singer has used "a generally

accepted method . . ." *In re Capacitors Antitrust Litig.* (No. III), No. 17-md-02801-JD, 2018 WL 5980139, at *6 (N.D. Cal. Nov. 14, 2018) (Donato, J.); *accord Milan v. Clif Bar & Co.*, 340 F.R.D. 591, 601 (N.D. Cal. 2021) (Donato, J.) (calling this a "key factor"). Plaintiffs also must show that Dr. Singer's methodology is "based on sufficient facts or data" and that he has "reliably applied the principles and methods to the facts of the case." Fed. R. Evid. 702(b), (d); *U.S. v. Hermanek,* 289 F.3d 1076, 1093 (9th Cir. 2002). This standard precludes "more than subjective belief or unsupported speculation." *Daubert*, 509 U.S. at 590–91. "[N]othing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert." *Gen. Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997). Courts exclude expert testimony based on assumptions that are "not sufficiently founded on facts." *Guidroz-Brault v. Missouri Pac. R.R. Co.*, 254 F.3d 825, 831–32 (9th Cir. 2001).

ARGUMENT

I. THE COURT SHOULD EXCLUDE TESTIMONY BASED ON DR. SINGER'S FORMULA FOR PASS-THROUGH INJURY AND DAMAGES.

Discovery confirms that Dr. Singer's formula for pass-through injury and damages is not reliable. It does not matter that a logit model is sometimes used for other kinds of antitrust analyses in other circumstances. As the Supreme Court has made clear, "scientific validity for one purpose is not necessarily scientific validity for other, unrelated purposes." *Daubert*, 509 U.S. at 591. Plaintiffs have the burden to show that Dr. Singer's formula in *this case* is reliable to determine in *this case* whether developers would have reduced their prices if they had paid lower service fees, and if so, by how much. Plaintiffs cannot meet that burden.

A. A Formula Based on Logit is Not Reliable Because Apps in Each Category Are Not Substitutes.

Plaintiffs cannot show that Dr. Singer's "methodology properly can be applied to the facts in issue." *Daubert*, 509 U.S. at 593. His formula for estimating injury and damages is based on a logit model of users' demand for apps, subscriptions and IAPs. Ex. 5, Tr. of Hr'g, July 19, 2022 at 115:24-25. If logit does not reliably model user demand, then Dr. Singer's formula derived from logit is not reliable. Economics is clear that logit cannot reliably model demand here, so Dr. Singer's formula based on logit demand is not reliable.

There is no dispute that "one feature of logit demand is that all goods in the market where demand is being measured are substitutes." Ex. 7, Singer Dep. at 158:6-13. In fact, Dr. Singer has testified multiple times that a basic condition of a logit model is that each product being studied must be a substitute for the others in proportion to their shares:

> Q. And one of the restrictions on the Logit model is known as the independence of a relevant alternative's property?
>
> A. Yes.
>
> Q. And the independence of a relevant alternative's property says that all products being studied in the Logit model should be substitutes in proportion to their share?
>
> 8 A. I think that's fair.

Ex. 4, Singer Merits Dep. at 84:25-85:8; *see also* Ex. 5, Tr. of Hr'g, July 19, 2022 at 116:8-12; Ex. 7, Singer Dep. at 154:24-155:9. Dr. Singer's own source from his merits report confirms this testimony: "The logit model is based on the restrictive assumption known as Independence of Irrelevant Alternatives (IIA). This assumption implies that when the price of one product is increased, consumers switch to others in proportion to the relative shares of those products." Ex. 10, Gregory J. Werden & Luke M. Froeb, *The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy*, 10 Journal of Law, Economics, & Organization 407, 420 (Oxford Univ. Press 1994) (citations omitted).

What Dr. Singer called the "standard textbook on Logit," Ex. 4, Singer Merits Dep. at 83:9-19, makes clear that a logit model of demand is not reliable if the products being studied are not substitutes in proportion to their shares: "Proportionate substitution can be realistic for some situations, in which case the logit model is appropriate. In many settings, however, other patterns of substitution can be expected, and imposing proportionate substitution through the logit model *can lead to unrealistic forecasts*." Ex. 8, Singer Dep. Ex. DX-1114, at 48.[2] As Nobel Laureate

[2] It does not matter whether these authorities refer to forecasts of "pass-through." Dr. Singer's formula for calculating pass-through is derived from a logit model of demand. Ex. 5, Tr. of Hr'g,

and Berkeley economics Professor Dan McFadden put it, a logit "model can produce *seriously misleading forecasts* if IIA fails." Ex. 9, Singer Dep. Ex. DX-1116, at 358 (emphasis added); *see also* Ex. 11, Daniel McFadden, "*Econometric Models of Probabilistic Choice," in Structural Analysis of Discrete Data with Econometric Applications*, pp. 222–223 (MIT Press, Cambridge 1981) ("…models satisfying [IIA] yield implausible conclusions when there are strong contrasts in the similarity of the alternatives").[3] Dr. Singer agrees that "the IIA does have to be respected." Ex. 4, Singer Merits Dep. at 94:5-10. And he testified that if consumers do not perceive apps in each category to be substitutes, then "you could get unreliable forecasts." *Id.* at 90:10-16; *see also id.* at 90:18-91:7.

According to these undisputed principles, Dr. Singer's formula derived from a logit demand model is not reliable because *he has conceded* that not all products in each app category are substitutes at all, let alone substitutes in proportion to their share of the categories:

Q. Is it your opinion that all apps in each Google Play app category are substitutes? A. No.	MR. RAPHAEL: And is it your opinion in this case that all apps in every Google Play category are substitutes in perfect proportion to their share? DR. SINGER: Not in perfect proportion.
Ex. 7, Singer Dep. at 158:14-16.	Ex. 5, Tr. of Hr'g, July 19, 2022 at 116:13-16.

See also Ex. 7, Singer Dep. at 159:6-25; Ex. 5, Tr. of Hr'g, July 19, 2022 at 116:25-117:3 ("Dr. Singer, is it your opinion that every app in each Google Play category is a substitute? DR.

July 19, 2022 at 115:24-25. If a logit model does not reliably forecast consumer demand in this case, then no formula derived from a logit model of demand is reliable.

[3] At class certification, the Court noted that Professor McFadden "modeled demand and supply conditions on a category-by-category basis." 2022 WL 17252587, at *11 (citing Case No. 4:11-cv-06714-YGR (N.D. Cal.), Dkt. No. 443-14 ¶ 211). The report that the Court cited is sealed, but the public version indicates that Professor McFadden did ***not*** use a logit model based on categories in the Apple App Store. Instead, he used a "log linear demand" model. *Id.*, Dkt. No. 643-11, ¶¶ 13-16, ¶ 180. Dr. Singer has no opinion regarding whether it would be appropriate to use a log linear model. Ex. 4, Singer Merits Dep. at 118:17-119:1. If a formula derived from logit were a reliable way to estimate app users' damages, it is hard to understand why an economist who won a Nobel Prize in part for work related to logit would not use that formula.

SINGER: I don't think that every one is a good substitute necessarily.").

Dr. Singer's admission is unsurprising because it is obvious that many apps in each Google Play store category are not substitutes, so their shares of those categories will not be informative regarding how their developers will set prices. There are many examples, but just one will do. QuickBooks Online Accounting is an accounting app. Thumbtack is an app that consumers can use to find professionals to help them with home improvement projects. Both are in the Business category. They are not substitutes. *See* Ex. 2, Leonard Rep. ¶ 66.

Dr. Singer may claim that he ran a regression to test the IIA assumption of proportional substitution for each app category. Not so. By his own admission, Dr. Singer's regression cannot show that substitution to other apps in the category would be proportional to other apps' shares because his regression does not measure where an app's share would go if it raised its price. Ex. 4, Singer Merits Dep. at 188:2-189:2. His regression merely purports to show that if a developer raised prices, then it would lose share of its category. *Id.* at 101:20-102:4.[4] Further, Dr. Singer could not identify *any* economic source to support his view his regression was an appropriate and reliable way to test for the IIA assumption of his logit model of demand. Ex. 4, Singer Merits Dep. at 102:6-20, 104:12-25, 105:7-21, 105:23-106:8. He testified: "I don't think that that's how you'd find it in a textbook." *Id.* at 104:12-25. Dr. Singer says that his regression tested whether logit "fit" the data, but when asked, "Are you aware of any source in economics that goodness of fit is an appropriate way to test for the IIA assumption," he answered: "No." *Id.* at 105:23-106:8.

The fact that Google identified the various app categories does not mean that all products in each category are substitutes, as required for a logit model to be reliable. Dr. Singer admits that Google did not identify the categories with the logit model or the IIA assumption in mind. *Id.* at 87:21-88:13. In fact, Google's maintenance of the categories says nothing about substitution between apps because Google does not even decide which apps are in each category. Developers each make that decision. *Id.* at 76:23-25. There is no evidence that any developer considers all

[4] The States' expert, Dr. Rysman, testified that this correlation does not indicate that logit is appropriate. Ex. 3, Rysman Dep. at 68:21-69:2.

other apps in the category it chooses to be substitutes for its app. Thus, it is no more reliable to determine how the developer of QuickBooks will set its price by determining its share of the Business category in the Google Play store than it would be to determine how a lamp manufacturer would set its prices using its share of all the products sold in the home furnishing section of a department store.

B. <u>Dr. Singer's Formula Does Not Account for Focal Point Pricing.</u>

Dr. Singer's model fails to account for focal point pricing—the wide-spread practice of choosing prices that end in "99." It is undisputed that from August 2016 to July 3, 3021, 97% of U.S. consumers' app transactions were set such that the retail prices ended in '99.'" *See* Ex. 2, Leonard Rep. at ¶ 32 n.7. Thus, Dr. Singer rightly testified that "focal point pricing is an important consideration here." Ex. 7, Singer Dep. at 202:2–7.

Focal point pricing is important because it affects whether developers would have reduced their prices if they had paid lower service fees. Suppose that (1) in the actual world, a developer sold a subscription for $1.99 subject to a 30% service fee of just under 60 cents and (2) in the but-for world the developer would have paid a service fee of 15%, or just under 30 cents—30 cents less than in the actual world. According to Dr. Singer's theory, the developer would pass on most of that 30 cents by reducing its price. But if the developer is committed to prices ending in "99," it would *not* reduce its $1.99 price by, say, 25 cents to $1.74. Thus, the States' economic expert, Dr. Marc Rysman, testified that he would not expect all developers that use focal point pricing to reduce their prices in reaction to lower service fees:

> And as a matter of economic principles, then, what you're saying is that, as a result of focal point pricing, some firms would not change price in response to a change in the commission rate?
>
> A. Yes. If focal point pricing is important, I would expect that.

Ex. 3, Rysman Dep. at 62:16-23.

As noted, Dr. Singer acknowledges that focal point pricing is important, but his formula does nothing to account for it. Other courts in this District have rejected expert testimony in

antitrust cases for that precise shortcoming. *E.g.*, *In re Apple iPhone Antitrust Litig.*, 2022 WL 1284104, at *8 (N.D. Cal. Mar. 29, 2022) ("Having failed to use or address the issue, the model does not provide a reliable method for determining but-for pricing in the presence of focal pricing."); *In re Lithium Ion Batteries Antitrust Litig.*, 2018 WL 1156797, at *3-5 (N.D. Cal. Mar. 5, 2018) (similar); *In re Optical Disk Drive Antitrust Litig.*, 303 F.R.D. 311, 324-25 (N.D. Cal. 2014) (similar). This Court should do the same.

C. Dr. Singer's Formula Does Not Account for Developers' Costs.

Dr. Singer's formula also is unreliable because does not account for developers' marginal costs other than service fees. Dr. Singer testified that, according to accepted economics, pass-through of a service fee that is a percentage of the developer's price will be proportional to the developer's other marginal costs. Ex. 7, Singer Dep. at 105:8–106:3, 107:23–109:14. *Accord* Ex. 2, Leonard Rep. ¶ 32. Suppose that Developer A and Developer B offer essentially the same product at the same price, and each has the same share in an app category. Even if Developer A and Developer B pay the same percentage service fee, Developer A would reduce its prices by more than Developer B because it has higher marginal costs other than the service fee. Thus, in order to determine the extent of any injury to consumers, an economist would have to know not just developers' service fees, but their other marginal costs as well.

Dr. Singer, however, has not estimated any developer's marginal costs other than the service fee and thus has not accounted for them in his formula. *See* Ex. 4, Singer Merits Dep. at 149:18–150:5; *see also* Ex. 7, Singer Dep. at 129:10–17, 186:6–18 (testifying that his pass-through damages "calculation doesn't reference the developer's other marginal costs in any way"). Dr. Singer's model thus will calculate the same pass-through rate and damages for consumers of two apps that have different marginal costs other than the service fee even though standard economics indicates that those developers would reduce prices (if at all) by different amounts. That is not a reliable model.

D. Dr. Singer's Formula Does Not Account for Available Data.

If the foregoing flaws in Dr. Singer's pass-through formula did not affect its reliability, then Dr. Singer should be able to show that his model accurately predicts how developers set

prices in the real world when Google reduced their service fee rates. However, Dr. Singer still has not conducted any statistical analysis showing that developers generally reduced their prices when Google reduced their service fee rates, which is what his model predicts *every single developer* would have done. Dr. Singer is avoiding the data because it does not support Plaintiffs' theory. *See Sidibe v. Sutter Health*, 333 F.R.D. 463, 498 (N.D. Cal. 2019) (finding pass-through model flawed where expert could not "explain how" defense expert's proof of far less than 100% pass-through was consistent with her theory, which "assume[s]" 100% pass-through).

Instead of proving pass-through, Dr. Singer has chosen a formula to guarantee it. Dr. Singer concedes that an app's pass-through rate will always be positive as long as it does not have a 100% share of its category. Ex. 4, Singer Merits Dep. at 73:15-19. That guarantees pass-through because no app has 100% share of its category. A model that guarantees pass-through may be useful to Plaintiffs, but it is not reliable. *See Sibide*, 333 F.R.D. at 497 (excluding pass-through analysis by expert who "assumed what she set out to prove—that the method by which health plans pass on their costs through their customers' premiums is in fact 'formulaic'").

II. DR. SINGER'S SUBSIDY MODELS ARE UNRELIABLE FOR PROVING INJURY OR DAMAGES.

The Court has not certified a class based on either of Dr. Singer's Play Point models for injury and damages. 2022 WL 17252587, at *13 ("The Court has not relied on the Play Points model for [class] certification, and leaves for another day the question of whether it might be presented to a jury."). Accordingly, Dr. Singer cannot opine on damages to the Consumer Plaintiff class based on those models. *Comcast*, 569 U.S. at 32. Indeed, Dr. Singer's opinion is that these Play Points models are designed to calculate *aggregate* damages. Ex. 4, Singer Merits Dep. at 163:10-25 ("What I'm trying to solve for is the extent of a subsidy that Google would have offered … in the aggregate across all users") (Play Points); *id.* at 164:1-15 (same); *id.* at 165:14-166:4 ("What the model is telling us is what's the [] aggregate or average subsidy that Google offers."); *id.* at 171:22-172:5 (Amazon Coins). Regardless, both of Dr. Singer's Play Point damages models are unreliable and should be excluded as to all plaintiffs.

A. Dr. Singer's Play Points Model is Unreliable.

The Play Points subsidy model that Dr. Singer advanced at the class certification stage is unreliable because it makes several baseless assumptions that dramatically affect Dr. Singer's analysis of injury and damages. *First*, although most users did not sign up for the Play Points program in the actual world, Ex. 4, Singer Merits Dep. at 162:20–163:4, Dr. Singer uses his Play Points model to determine injury and calculate damages for all users of the Google Play store. But Dr. Singer has no basis to opine that *all* users were injured or damaged because *all* of them would have signed up for Play Points. In fact, at his deposition, Dr. Singer disclaimed "the opinion that all users in the but-for world would have signed up for the Google Play Points program," saying "I don't know if the model can tell us that." *Id.* at 165:14-21. He further testified that "I don't think the model tells you whether a user will sign" up. *Id.* at 166:15–167:10.

In his report, Dr. Singer posited that "[c]onsumers would have enhanced economic incentives to enroll and participate in a Play Points offering more valuable incentives in the but-for world," Ex. 1, Singer Rep. ¶ 381, which he called a "safe inference" at his deposition. Ex. 4, Singer Merits Dep. at 167:4. But "there are costs to opting into a rewards program," *id.* at 163:5-8, and Dr. Singer has not "calculated the percentage credit on the price that would be necessary for any consumer to find it worth it to overcome the cost of signing up and sign up for the Play Points program." *Id.* at 168:19–169:7, 167:11-25. He has not analyzed the relationship between the value of Play Points and demand for the program or the elasticity of demand for that program. Dr. Singer therefore has no basis to opine that more valuable Play Points would have stimulated *all* users to sign up for the Play Points program. All he can do is speculate that "consumers *could* be automatically enrolled in Play Points." Ex. 1, Singer Rep. ¶ 381 (emphasis added). But Dr. Singer acknowledged that some rewards programs do not automatically enroll users. Ex. 4, Singer Merits Dep. at 175:21-176:9. Dr. Singer has no evidence that Google would have automatically enrolled users in Play Points.

Second, Dr. Singer's Play Points model improperly uses the market for long-distance telephone service in the 1980s as a benchmark for modeling the but-for world. *In re Apple iPhone Antitrust Litig.*, 2022 WL 1284104, at *4 (excluding expert opinion for "cherry picking"

benchmarks). One input into Dr. Singer's Play Points model is Google's market share in the but-for world, which Dr. Singer estimates would have been 60% because that was AT&T's share of the long-distance telephone services market after 1982. *See* Ex. 1, Singer Rep. ¶ 386 & Table 16; *see also id.* ¶ 331 & Table 8; *cf. also* Ex. 2, Leonard Rep. ¶¶ 91-97. Another input into Dr. Singer's Play Points model is the elasticity of demand. *See* Ex. 1, Singer Rep. ¶ 328. Rather than calculate this elasticity, Dr. Singer relied on figures from an article about long-distance telephone services after 1982. *See id.* ¶¶ 326–332 & Table 8; *cf.* Ex. 2, Leonard Rep. ¶¶ 101-104, 109.

The market for landline long-distance telephone services in the 1980s is not a reliable benchmark for a competitive but-for world in markets related to smartphone apps and app transactions. After all, Dr. Singer himself opines that even "*1990s-era* 'flip phones'" are "economically irrelevant here." *Id.* ¶ 70 (emphasis added).[5] Dr. Singer's only justification for using 1980s long-distance calling is that AT&T was "benefitting from network effects" before the divestiture order. Ex. 6, Singer Rebuttal Rep. Errata ¶ 42. However, Dr. Singer cannot explain why he chose AT&T rather than any other firm that benefits from network effects and faces a competitive market. Such cherry-picking is not reliable.

B. <u>Dr. Singer's Amazon Coins Model is Unreliable.</u>

For the first time at the merits stage, Dr. Singer uses the Amazon Coins program in the Amazon Appstore as a benchmark to develop an alternative estimate of the value of Play Points that Google supposedly would have offered users in the but-for world. Dr. Singer uses that model "for calculating *aggregate* damages," Ex. 1, Singer Rep. ¶ 418 (emphasis added), and thus cannot present it on behalf of the putative class. The model also is not reliable for several reasons.

First, as with his model in which he directly calculates the Play Points Google supposedly would have offered, Dr. Singer's Amazon Coins model calculates aggregate damages for *all* users even though Dr. Singer has no basis to assume that all users would have signed up for Play Points. He assumes "that it would be irrational and illogical for a consumer to pass up" the savings he

[5] Dr. Singer's suggestion, Ex. 1, Singer Rep. ¶ 329, that using AT&T long-distance is "conservative" because Alcoa had an even lower share of the steel market after World War II simply confirms that Dr. Singer's benchmarks have nothing to do with this case.

says Google would have offered, but this is speculation: Dr. Singer has not "studied, with respect to [his] Amazon Coins model, the percentage of savings that would be necessary to get all users of the Google Play Store to sign up." Ex. 4, Singer Merits Dep. at 172:13-173:7.

Second, Dr. Singer has not demonstrated that the Amazon Coins program is a reliable benchmark for a Google Play Points program. Dr. Singer assumes Google would have offered Play Points equal to the same percentage of Play's revenue as the percentage of Amazon Coins discounts to Amazon's revenue from the Amazon Appstore. Ex. 1, Singer Rep. ¶ 420. That comparison is completely arbitrary. Dr. Singer does not explain why Google would have offered Play points equal to the same percentage of its revenue as the Amazon Appstore when he estimates that Google's market share in the but-for would have been more than 30 times Amazon's actual market share. *See id.* ¶ 331 (estimating Google's but-for market share at 60%); *id.* at ¶ 120 (estimating Amazon Appstore's market share at <1%). Nor has Dr. Singer accounted for significant differences between Play Points and Amazon Coins. Users earn Play Points from buying apps, subscriptions or IAPs. Amazon Coins must be purchased separately. Ex. 4, Singer Merits Dep. at 183:10-16. Users can redeem Play Points for apps, subscriptions or IAPs, but they cannot redeem Amazon Coins for subscriptions. *See* Ex. 2, Leonard Rep. ¶ 111. Dr. Singer ignores these distinctions.

Dr. Singer notes that "[t]he Amazon Appstore, like the Play Store, participates in [the] Android App Distribution Market." Ex. 1, Singer Rep. ¶ 418. But numerous other app stores participate in the alleged Android app distribution market. Dr. Singer has not explained why the Amazon Appstore is a better benchmark than those other app stores. Nor did he analyze whether any other app stores that his report identifies as potential benchmarks would be better benchmarks than the Amazon Appstore. Ex. 4, Singer Merits Dep. at 183:1-5. That makes his model based on Amazon Coins "arbitrary and not based on any legitimate scientific, economic, or mathematic principle." *In re Apple iPhone Antitrust Litig.*, 2022 WL 1284104, at *3 (excluding benchmark analysis for "cherry-picking" app stores as benchmarks).

CONCLUSION

Dr. Singer's testimony based on his injury and damages models should be excluded.

Respectfully submitted,

Dated: April 20, 2023

By: /s/ Justin P. Raphael
Justin P. Raphael

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E-FILING ATTESTATION

I, Justin P. Raphael, am the ECF User whose ID and password are being used to file this document. In compliance with Civil Local Rule 5-1(h)(3), I hereby attest that each of the signatories identified above has concurred in this filing.

/s/ Justin P. Raphael
Justin P. Raphael

Exhibit E2
Public Redacted Version

EXHIBIT 1

FILED UNDER SEAL

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

IN RE GOOGLE PLAY STORE ANTITRUST LITIGATION THIS DOCUMENT RELATES TO: *In re Google Play Consumer Antitrust Litigation*, Case No. 3:20-cv-05761-JD *State of Utah et al. v. Google LLC et al.*, Case No. 3:21-cv-05227-JD	No. 3:21-md-02981-JD **MERITS REPORT OF** **HAL J. SINGER, PH.D.** Judge: Hon. James Donato

PARTY AND NON-PARTY HIGHLY CONFIDENTIAL – ATTORNEYS' EYES ONLY

INTRODUCTION AND SUMMARY OF CONCLUSIONS

1. Google Play (the "Play Store"), owned and operated by Google,[1] is the largest distributor of Android-compatible software applications for mobile devices ("Apps") and the only store that can reach virtually every Android mobile user outside of China.[2] With limited exceptions, Google has until very recently charged a uniform headline "take rate"[3] equal to 30 percent of all revenues on the initial sale and downloading of Apps from the Play Store and the subsequent sale of digital content consumed within Apps ("In-App Content").[4] Counsel for Mary Carr, Daniel Egerter, Zack Palmer, Serina Moglia, Matthew Atkinson, and Alex Iwamoto, on behalf of themselves and all others similarly situated[5] (the "Consumer Plaintiffs" or "Classes"), have asked me to assess Google's market power in App distribution and related markets, the competitive effects of the various restrictions Google enforces, and other conduct Google has undertaken in connection with its Play Store (collectively, the "Challenged Conduct").[6] I have also been asked to assess on behalf of the Consumer Plaintiffs and Plaintiff States[7] whether, as a result of the Challenged Conduct, consumers have overpaid for the initial downloads of Apps through the Play Store or for subsequent purchases of In-App Content, and to calculate aggregate damages for U.S. Consumers resulting from any such overpayments, including the Damages Class.[8]

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1. Google includes Google, LLC, Google Ireland Ltd., Google Commerce Ltd., Google Asia Pacific Pte. Ltd., and Google Payment Corp.

2. All of the relevant geographic markets at issue here are worldwide excluding China, where the Play Store is blocked. *See, e.g.,* Sherisse Pham, *Google now has two Apps in China, but search remains off limits*, CNN BUSINESS (May 31, 2018), money.cnn.com/2018/05/31/technology/google-in-china-files-app/index.html ("The company's own App store, Google Play, remains blocked in China[.]"); *see also* Part I.B below. All references to "global" markets or the use of the terms "globally" or "world" in this report assume that China is excluded unless stated otherwise.

3. To describe its price to developers, Google uses the terminology "revenue share," which reflects the fact that Google is taking a portion of the developers' revenues, injecting itself as a "partner" in the customer-developer relationship. (Google sometimes uses the term "service fee" instead of "revenue share.") Google also uses the term "revenue share" to refer to the portion of the take rate Google has shared with mobile carriers and original equipment manufacturers. For ease of exposition, I use the term "take rate" to capture Google's price charged to developers.

4. As shown in Tables 6 and 8, *infra*, Google's average take rate across all transactions on the Play Store during the Class Period (August 16, 2016 through May 31, 2022) exceeds [redacted] percent for both initial downloads and In-App Content. The reason why the average take rate is slightly below 30 percent is that Google gives discounts from its baseline rate under certain limited circumstances described in this report. While Google's online policies have changed over time, In-App Content as used in this report is consistent with what Google refers to as "in-App purchases." Google's current policy states: "Play-distributed Apps requiring or accepting payment for access to in-App features or services, including any App functionality, digital content or goods (collectively "in-App purchases"), must use Google Play's billing system for those transactions" subject to discrete exceptions. *See* Play Console Help, https://support.google.com/googleplay/android-developer/answer/9858738.

5. The Classes refer to a class seeking damages (the "Damages Class") and a class seeking injunctive relief (the "Injunctive Class") as defined in Plaintiffs' class certification motion in *In re Google Play Consumer Antitrust Litigation*, Case No. 3:20-cv-05761-JD. *See* [Corrected] [Proposed] Order Granting Consumer Plaintiffs' Mot. For Class Certification (July 28, 2022) ¶¶1-2.

6. The Challenged Conduct includes Google's anticompetitive conduct in all of the relevant antitrust markets at issue here.

7. The Plaintiff States are those states where States Attorneys General have filed claims in *State of Utah et al. v. Google LLC et al.*, Case No. 3:21-cv-05227-JD.

8. In this report, unless otherwise explicitly stated, I calculate aggregate damages for all U.S. Consumers (defined as those with a billing address in the United States or its territories) who paid for an App through the Play Store or paid for In-App Content (including subscriptions or ad-free versions of apps) through Google Play Billing (as defined herein) on or after August 16, 2016, to the present ("U.S. Consumers").

2. In this report, I conclude that Google has monopoly power[9] in the market for licensable mobile operating systems, and in the market for the sale and distribution of Apps for Android mobile devices (the "Android App Distribution Market"). Google has gained and maintained such power through the imposition of exclusionary contractual provisions and artificial technological barriers that unnecessarily impede the distribution of Apps outside of the Play Store. I further conclude that Google has extended its power in the Android App Distribution Market into the aftermarket for services in support of consummating purchases of In-App Content on Android devices (the "In-App Aftermarket"). Google has gained and maintained significant market power in the In-App Aftermarket through anticompetitive, exclusionary contractual restrictions (the "Aftermarket Restrictions") that function as an economic tie-in of Google's Android App Distribution Market services to its In-App Aftermarket services. I conclude that the Challenged Conduct was anticompetitive; to the extent that there are any procompetitive benefits of the Challenged Conduct, they could have been achieved through less restrictive alternatives.[10]

3. I also demonstrate that, in the absence of Google's anticompetitive conduct, U.S. Consumers would have paid lower prices for both paid Apps and In-App Content. My analysis demonstrates that the Challenged Conduct resulted in antitrust injury to all or almost all U.S. Consumers, as well as members of the Injunctive Class. U.S Consumers suffered aggregate damages of [redacted] resulting from pass-through of cost savings from lower take rates.[11] I also present models that do not require proof of pass-through, because injury and damages result from a diminution in direct customer discounts, with aggregate damages of up to [redacted][12] I also present a methodology for calculating damages for each individual U.S. Consumer. My conclusion that the Challenged Conduct was anticompetitive and caused antitrust injury to all or almost all U.S. Consumers and members of the Injunctive Class holds regardless of whether there are two relevant markets or just one.[13] In addition to the antitrust injury demonstrated herein, consumers

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9. Consistent with common practice in economics, I use the terms "market power" and "monopoly power" interchangeably. *See, e.g.,* DENNIS CARLTON & JEFFREY PERLOFF, MODERN INDUSTRIAL ORGANIZATION 244-282 (Pearson 2005 4th ed.).

10. In my class certification reports, I demonstrated how data, economic methods, and evidence common to all U.S. Consumers could be used to prove that consumers nationwide suffered antitrust injury attributable to Google's anticompetitive conduct. Absent Google's conduct, the prices consumers pay for applications would have been lower, or Google would have given U.S. Consumers a direct discount in the form of direct rewards and incentives, such as Play Point subsidies. Much of the analysis from my class certification report is incorporated and updated herein. *See* Class Certification Report of Hal J. Singer, PhD (February 28, 2022) [hereafter, "Singer Class Cert Report"]; *see also* Class Certification Reply Report of Hal J. Singer, PhD (April 25, 2022) [hereafter, "Singer Class Cert Reply"]; *see also* Class Certification Reply Report of Hal J. Singer, PhD (Errata) (May 10, 2022) [hereafter, "Singer Class Cert Reply Errata"].

11. These damages are calculated using a two-sided market model of App distribution and a one-sided model of the In-App Aftermarket. I sometimes refer to these two models collectively as the "App/In-App Model." All of my economic models use Play Store transaction data produced by Google ("Google Transactional Data"). The Google Transactional Data includes billions of records, and was produced in two batches. The first batch (GOOG-PLAY-007203251) was produced on July 27, 2021, and includes U.S. transactions from November 2010 through July 3, 2021. The second batch was produced on August 17, 2022, and includes U.S. transactions between July 4, 2021 through May 31, 2022.

12. These damages are calculated using a two-sided market model in which competition occurs over customer discounts ("Discount Model"), as well as a damages model based on the discounts that Amazon provides to customers accessing the Amazon Appstore via Google Android devices ("Amazon Discount Model").

13. I estimate a two-sided market model in which a single take rate applies to all paid transactions ("Single Take Rate Model"). In addition, neither the Discount Model nor the Amazon Discount Model require separate markets for App distribution and In-App purchases.

would also have benefitted further from enhancements to output, quality, and consumer choice in a more competitive but-for world.[14]

4. I have reviewed numerous materials to inform my opinions. The record documents and deposition testimony that I have relied upon are footnoted throughout this report.[15] I have also relied on academic literature, press reports, industry reports, government reports, court cases, and other materials, which are footnoted in this report and/or listed in Appendix 2. I have also relied on various datasets, including the Google Transaction Data, other data produced by Google, third-party data from IDC, Statcounter, Statista, and other sources, which are footnoted in this report and/or listed in Appendix 2. In preparing this report, I was assisted by a staff of expert economists and analysts. I directed their analyses and activities. My staff has had access to transcripts of all depositions taken in this matter and all materials produced in this matter through the document management database.[16]

QUALIFICATIONS

5. I am a managing director at Econ One, an economic consulting firm which provides expert economic and econometric analysis for antitrust cases. I am also an Adjunct Professor at the University of Utah, where I teach antitrust economics to graduate students in economics.

6. I am an applied microeconomist with an emphasis on industrial organization and regulation. In an academic capacity, I have published several books and book chapters, spanning a range of industries and topics, and my articles have appeared in dozens of legal and economic journals. My competition-related articles have appeared in multiple American Bar Association (ABA) Antitrust Section journals, and I have been a panelist at several ABA Antitrust events. In a consulting capacity, I have been nominated for antitrust practitioner of the year among economists by the American Antitrust Institute (AAI) for my work in *Tennis Channel v. Comcast*, and AAI named me as co-Honoree in the same category in 2018 for my work *In Re Lidoderm Antitrust Litigation*. I have specific experience and expertise in antitrust class action cases focusing on labor-side markets, like the Grower market here. For instance, I have served as an expert in antitrust cases on behalf of proposed and certified classes of mixed martial arts fighters, nurses, and other employees.

7. I have testified as an economic expert in state and federal courts, as well as before regulatory agencies. I also have testified before the House Judiciary Subcommittee on Antitrust

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14. Plaintiffs have proposed injunctive relief for an injunctive class. *See* [Corrected] [Proposed] Order Granting Consumer Plaintiffs' Mot. For Class Certification (July 28, 2022) ¶2. This report demonstrates widespread and substantial antitrust injury resulting from the Challenged Conduct. Accordingly, the proposed injunctive class would benefit from removal of the Challenged Conduct.

15. Consistent with standard practice, my economic opinions herein rely in part on qualitative evidence such as documents and deposition testimony. *See, e.g.,* Jonathan B. Baker & Timothy F. Bresnahan, *Economic Evidence in Antitrust: Defining Markets and Measuring Market Power*, *in* Paulo Buscossi, ed. HANDBOOK OF ANTITRUST ECONOMICS (2007) [hereafter, "Baker & Bresnahan"], at 4 ("[W]e give qualitative and quantitative evidence equal attention below when we discuss identification with respect to the market definition and market power inquiries."). Qualitative evidence is typically important for understanding the facts that inform an applied economic analysis (as opposed to a purely theoretical exercise). I do not offer any expert opinions as to the interpretation of individual documents, deposition testimony, or other qualitative evidence.

16. I and my staff have access to the full set of depositions taken to date in this matter, although I did not specifically rely on all of them in forming my opinions.

and the Senate Judiciary Subcommittee on Competition Policy, Antitrust, and Consumer Rights on the interplay between antitrust and sector-specific regulation. Federal courts have relied on my work in certifying seven classes in antitrust matters,[17] and two classes in consumer protection matters.[18] My full curriculum vitae appears as Appendix 1 to this report and reflects a full list of the cases in which I have served as a testifying expert since 2014 and a list of publications I have authored in the last ten years.

8. Econ One is compensated at my standard hourly rate of $885 for my work in this matter. My compensation is not contingent on my opinions or the outcome of this case.

INDUSTRY OVERVIEW

9. Smart mobile devices, and smartphones in particular, have become ubiquitous in daily life, essential providers of communication, entertainment, and information.[19] These hand-held portable computers can be used almost anywhere, allowing us to connect to the internet from any location that offers the requisite cellular or wi-fi network. Whether you want to buy stock in GameStop, check the score of the San Francisco 49ers game, or call your mother—mobile devices do it all.

10. Like the mini-computers they are, mobile devices are comprised of both hardware and software. The hardware typically consists of an LCD or OLED flat screen and some combination of physical buttons, digital keypads, and, ever more frequently, a touchscreen interface.[20] As with desktop or laptop computers, mobile devices are controlled by an operating

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17. *See Meijer, Inc. v. Abbott Laboratories*, No. C 07-5985 CW, 2008 WL 4065839 (N.D. Cal. Aug. 27, 2008) (Order Granting Plaintiffs' Motion for Class Certification); *Natchitoches Parish Hosp. Serv. Dist. v. Tyco Intl., Ltd.*, 262 F.R.D. 58 (D. Mass. 2008) (Granting Motion to Certify Class); *Southeast Missouri Hospital and St. Francis Medical Center v. C.R. Bard*, No. 1:07cv0031 TCM, 2008 WL 4372741 (E.D. Mo. Sept. 22, 2008) (Granting in Part Motion for Class Certification); *Johnson v. Arizona Hosp. and Healthcare Assoc.* No. CV 07-1292-PHX-SRB, 2009 WL 5031334 (D. Ariz. July 14, 2009) (Granting in Part Motion for Class Certification); *In re Delta/AirTran Baggage Fee Antitrust Litig.,* 317 F.R.D. 665 (N.D. Ga. 2016) (Granting Motion to Certify Class); and *In re Lidoderm Antitrust Litig.*, No. 12-md-02521, 2017 WL 679367 (N.D. Cal. Feb. 21, 2017) (Order Granting Motions for Class Certifications and Denying Daubert Motions); *Cung Le, et al. v. Zuffa*, *LLC d/b/a Ultimate Fighting Championship*, Minute Entry, 2:15-cv-01045-RFB-BNW (D. Nev. Dec. 10, 2020), ECF No. 781 (announcing the court's intention to grant the Plaintiffs' Motion for Class Certification). As of the time of this report, the court has not issued the written opinion certifying the class in *Zuffa*.

18. *See In Re: MacBook Keyboard Litigation,* Case No. 5:18-cv-02813-EJD, 2021 WL 1250378 (N.D. Cal., Mar. 8, 2021) (Order Granting Motion to Certify Class); *In Re: JUUL Labs, Inc., Marketing, Sales Practices, and Products Liability Litigation*, Case No. 19-md-02913-WHO (N.D. Cal., Dec. 5, 2021) (Tentative Opinions on Motion for Class Certification, Daubert Motions, and Motion to Dismiss Bellwether Claims).

19. Smartphone ownership in the United States has more than doubled in the past ten years. As of 2021, 85 percent of adults in the U.S. owned a smartphone, up from 35 percent in 2011. *See* PEW RESEARCH CENTER, *Mobile Fact Sheet* (April 7, 2021), pewresearch.org/internet/fact-sheet/mobile/. *See also* U.S. CENSUS BUREAU, *Computer and Internet Use in the United States: 2018* (April 2021), census.gov/content/dam/Census/library/publications/2021/acs/acs-49.pdf at 2 (As of 2018, "[s]martphone ownership surpassed ownership of all other computing devices. Smartphones were present in 84 percent of households, while 78 percent of households owned a desktop or laptop. Tablet ownership fell behind at 63 percent.").

20. *See* IGI GLOBAL, HANDBOOK OF RESEARCH ON THE SOCIETAL IMPACT OF DIGITAL MEDIA, igi-global.com/dictionary/use-of-Apps-and-devices-for-fostering-mobile-learning-of-literacy-practices/18837 ("A mobile device is a computing device small enough to hold and operate in the hand. Typically, any handheld computer device will have an LCD or OLED flat screen interface, providing a touchscreen interface with digital buttons and keyboard or physical buttons along with a physical keyboard.").

system ("OS"), software that manages the device's hardware and software resources. Mobile operating systems provide the essential platform for the real work—and play—on mobile devices, which is performed by consumer "applications," more commonly known as "Apps," which are software programs designed to perform myriad functions.[21] Apps are typically displayed on the device screen through a representative image, known as an icon, and can be called by the user through a touch, a tap, or the click of a button. The App and the OS communicate with each other through an Application Program Interface ("API").[22] In addition, software development kits ("SDKs") facilitate App development by providing App developers with key functionality (relating to advertising, analytics, geolocation, payments, and many other areas) that the developer does not need to create from scratch.[23] Through their control of key software such as APIs and SDKs, mobile device operating systems exercise control over how an App can be developed to function on a given device. Mobile operating systems are not cross-compatible; an App designed to run on one operating system must be substantially re-written to function on a distinct operating system.[24]

11. Smartphone hardware is designed and produced by original equipment manufacturers ("OEMs"). As seen below, Samsung and Apple are the largest OEMs; others include LG, Lenovo, Nokia, and Huawei. Globally, Samsung and Apple accounted for more than

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21. *See, e.g.,* Case AT.40099—Google Android, Comm'n Decision, ¶228 (July 18, 2018) (summary at 2018 O.J. C (402) 19), ec.europa.eu/competition/antitrust/cases/dec_docs/40099/40099_9993_3.pdf ("The ability to install and use applications is a defining characteristic for a smartphone OS."). *See also* Catherine Hiley, *What are the different mobile operating systems*? USWITCH (July 12, 2022), uswitch.com/mobiles/guides/mobile-operating-systems/ ("Modern smartphones are closer to handheld computers that enable us to send emails, play games, watch the news and make video calls to loved ones. And much more besides. Operating systems are the software that run our desktop computers and laptops and manage their resources and memory when they're being used for multi-tasking. Smartphones have their own operating systems – also known as mobile OS – and it's this development that has brought advanced functions to mobiles that were previously only available on our computers. It's also a platform that developers can create applications or 'Apps' (software programs developed for smartphones that can carry out specific functions)[.]").

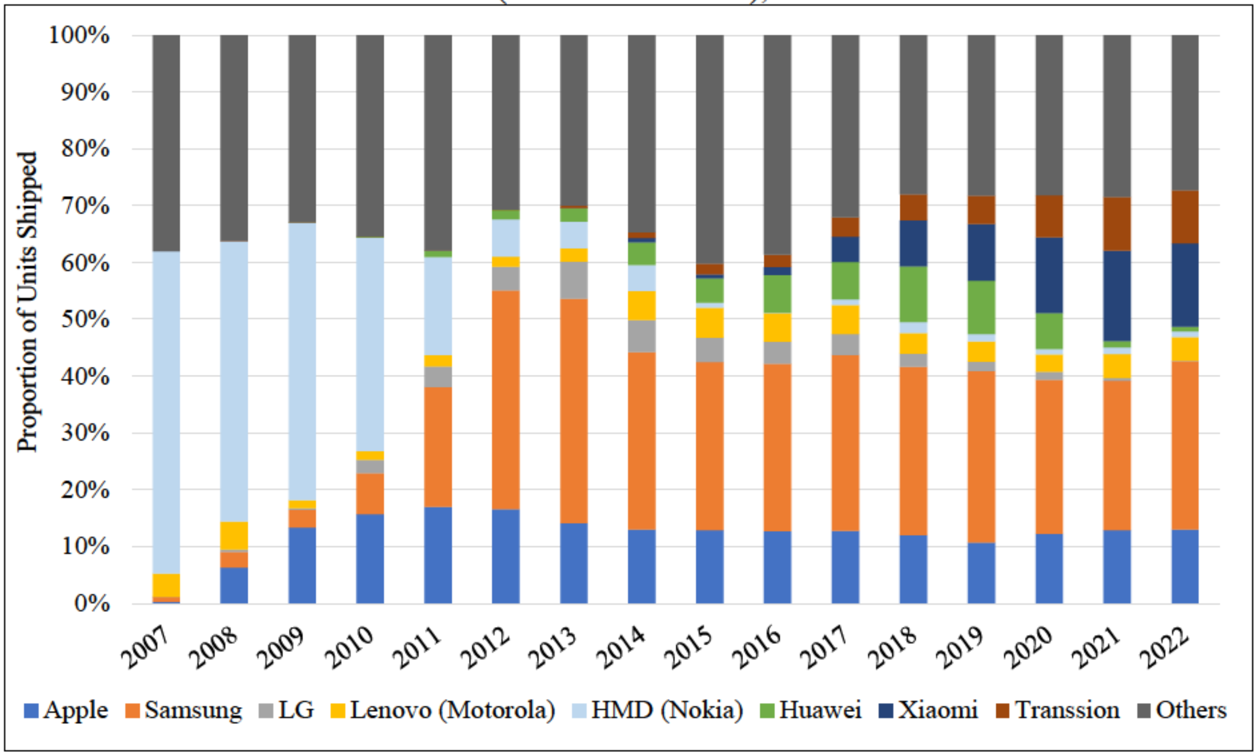
22. *See* Tom Nolle, *application program interface (API)*, TECHTARGET, techtarget.com/searchapparchitecture/definition/application-program-interface-API ("An application program interface (API) is code that allows two software programs to communicate with each other. An API defines the correct way for a developer to request services from an operating system (OS) or other application, and expose data within different contexts and across multiple channels."). *See also* Google APIs Explorer, developers.google.com/apis-explorer.

23. *See, e.g.,* APPFIGURES, *What's a Mobile SDK?*, appfigures.com/support/kb/626/whats-a-mobile-sdk ("A Software Development Kit, SDK for short, is a set of pre-written tools that provide App developers functionality that they don't have to write themselves…The most common types of SDKs you'll see in most Apps include: ads & monetization SDKs, analytics SDKs, and non-native development SDKs. But there are many others, like simple networking utilities, payments, notifications, and others.").

24. *See* Lionel Valdellon, *What Are the Different Types of Mobile Apps? And How Do You Choose?*, CLEVERTAP (Sep. 20, 2022), clevertap.com/blog/types-of-mobile-Apps/ ("Native Apps are built specifically for a mobile device's operating system (OS). […] [T]he problem with native Apps lies in the fact that if you start developing them, you have to duplicate efforts for each of the different platforms. The code you create for one platform cannot be reused on another. This drives up costs. Not to mention the effort needed to maintain and update the codebase for each version."). *See also* Jason Turnquist, *How Much Does App Development Cost?*, FYRESITE (July 31, 2020), fyresite.com/how-much-does-app-development-cost/ (Detailing how Uber might seem like one app, but is in reality four Apps: "a native iOS App for drivers, a native Android App for drivers, a native iOS App for riders, and a native android App for riders," where each new permission [app] created increases the price to develop it).

35 percent of smartphone shipments in 2021 and more than 40 percent of shipments in the first half of 2022. In the U.S., Samsung and Apple accounted for more than 73 percent of smartphone shipments in 2021 and through the first half of 2022. A number of OEMs, such as Amazon and LG, have exited the smartphone market over the years.[25] Some OEMs based in China, such as Huawei, Xiaomi, Vivo and Oppo, have expanded their footprint beyond China itself.[26]

FIGURE 1: OEM SHARE OF SMARTPHONE UNIT SHIPMENTS WORLDWIDE (EXCLUDING CHINA), 2007 – 2022

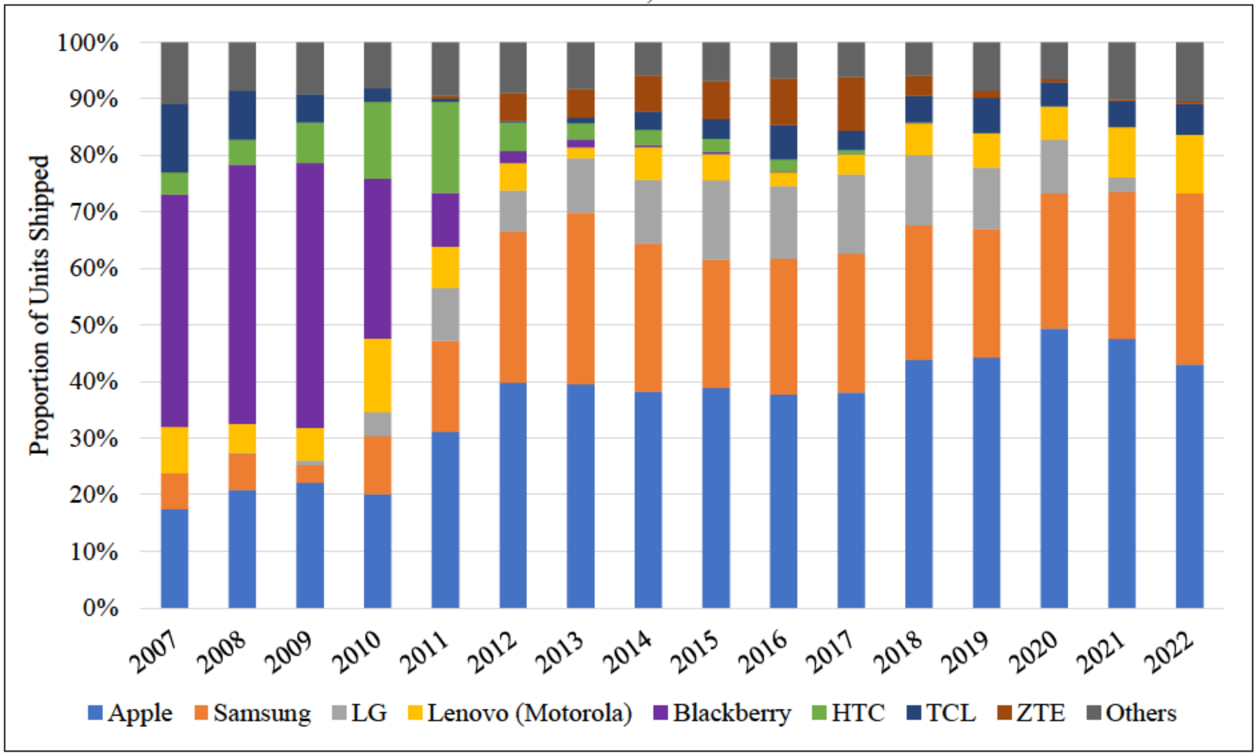


Source: IDC Worldwide Quarterly Mobile Phone Tracker. Appendix 8 displays comparable data for tablets. Data goes through 2022Q2.

25. *See, e.g.,* Tricia Duryee, "Amazon finally stops selling the Fire Phone, as company adjusts its hardware strategy," GEEKWIRE (Sept. 8, 2015), https://www.geekwire.com/2015/amazon-finally-stops-selling-the-fire-phone/; *see also* Ron Amadeo, *After a decade of failure, LG officially quits the smartphone market*, ARS TECHNICA (April 5, 2021), arstechnica.com/gadgets/2021/04/after-a-decade-of-failure-lg-officially-quits-the-smartphone-market/.

26. *See, e.g.,* Cheng Ting-Fang & Lauly Li, *China's Xiaomi, Vivo and Oppo trim smartphone orders by 20%*, FINANCIAL TIMES (May 25, 2022) (showing global market shares for Chinese OEMs). *See also* Scott Cendrowski, *How China's Smartphone 'Big Four' Are Fighting for Global Customers*, FORTUNE (Jan. 24, 2017), fortune.com/2017/01/24/china-smartphones-oppo-vivo-huawei-xiaomi/.

FIGURE 2: OEM SHARE OF SMARTPHONE UNIT SHIPMENTS
UNITED STATES, 2007 - 2022



Source: IDC Worldwide Quarterly Mobile Phone Tracker. Appendix 8 displays comparable data for tablets. Data goes through 2022Q2.

12. OEMs manufacture smartphones to run on wireless broadband networks owned and maintained by mobile network operators, also known as wireless carriers ("carriers"). Following the 2020 Sprint/T-Mobile merger, the U.S. currently has three dominant carriers (Verizon, AT&T, and T-Mobile).[27] These three carriers account for nearly 100 percent of U.S. wireless subscriptions, as did the top four carriers prior to the Sprint/T-Mobile merger.[28] Other countries have similar industry structures.[29] For example, the three dominant wireless carriers in Japan (NTT Docomo, KDDI Group, and SoftBank) accounted for over 97 percent of mobile subscribers in 2022, and this industry structure has remained stable since at least 2015.[30] Prior to the launch of Android mobile

27. *See, e.g.*, Marguerite Reardon & Roger Cheng, *T-Mobile and Sprint are one: What you need to know about the mobile mega-merger*, CNET (Apr. 3, 2020), cnet.com/tech/mobile/t-mobile-and-sprint-are-one-what-you-need-to-know-about-the-mobile-mega-merger/.

28. *See, e.g.*, Statista, *Wireless subscriptions market share by carrier in the U.S. from 1st quarter 2011 to 1st quarter 2022* (Sep. 9, 2022), statista.com/statistics/199359/market-share-of-wireless-carriers-in-the-us-by-subscriptions/.

29. *See, e.g.*, OECD, *Emerging Trends In Communication Market Competition*, OECD DIGITAL ECONOMY PAPERS (September 2021) at 15-16.

30. *See, e.g.*, Statista, *Distribution of mobile phone subscribers in Japan from 2015 to 2022, by operator* (Aug. 8, 2022), statista.com/statistics/892503/japan-mobile-phone-market-subscription-share-by-operator/ (showing that the three dominant Japanese carriers and their corresponding mobile virtual network operators ("MVNOs") account for the vast majority of Japanese mobile subscribers).

devices, carriers and OEMs provided not only the hardware for mobile devices, but also most of the software for their own devices.

13. When designing smartphones, OEMs must include a mobile OS that allows the device's hardware to run applications and programs.[31] Today, the only two major mobile device operating systems globally (excluding China) are Apple's iOS and Android.[32] Collectively, Google's Android and Apple's iOS make up over 99 percent of smartphones worldwide, excluding China.[33] Apple is the exclusive hardware producer of its popular iPhone (smartphone) and iPad (tablet) devices, which run Apple's proprietary iOS operating system. As seen below, even if one were to assume counterfactually that the relevant antitrust market includes iOS, there is a virtual duopoly in the market for mobile device operating systems, with the market split between mobile devices running on Apple's iOS and Google Android.[34] Mobile OSs other than Android and iOS comprise only a tiny fraction of the market. Figures 3A and 3B display mobile OS market shares based on smartphone unit sales. Android accounts for the vast majority of the mobile OS market globally, and for approximately 50 to 60 percent of the mobile OS market in the U.S. Industry analysts attribute the difference in market penetration to the higher cost of the iPhone, which is beyond the means of many non-U.S. residents.[35] In contrast, as late as 2010, iOS and Android together accounted for less than 40 percent of mobile operating systems worldwide, excluding China.[36] As seen in Appendix 8, market shares for tablets are similar, although the Windows OS has a small share.

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31. *See, e.g.,* Colin Steele, Definition: mobile operating system, TECH TARGET (March 2020), techtarget.com/searchmobilecomputing/definition/mobile-operating-system ("A mobile operating system (OS) is software that allows smartphones, tablet PCs (personal computers) and other devices to run applications and programs.").

32. *See, e.g.,* Sherisse Pham, *Google now has two Apps in China, but search remains off limits*, CNN BUSINESS (May 31, 2018), money.cnn.com/2018/05/31/technology/google-in-china-files-app/index.html ("The company's own App store, Google Play, remains blocked in China[.]").

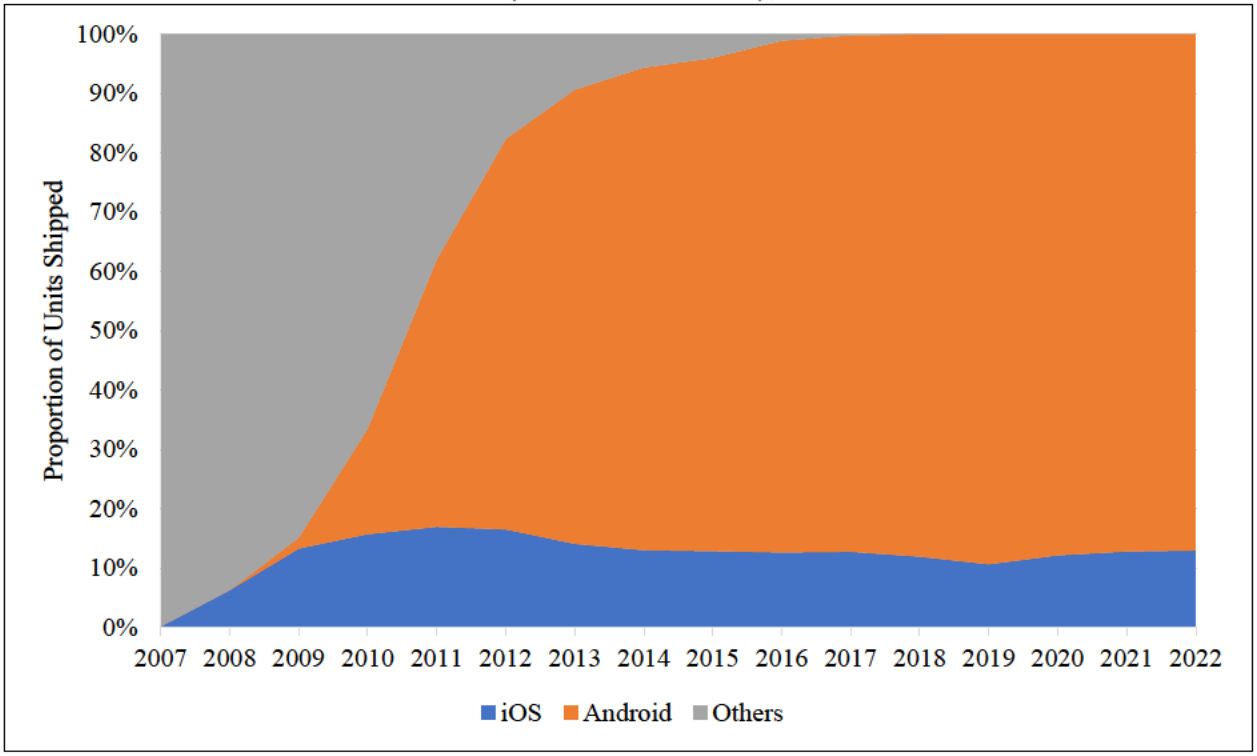
33. *See* Figures 3A-3B below. It bears noting that Android and Apple jointly dominate the marketplace for mobile operating systems in China as well. *See* Statista, *Market share of mobile operating systems in China from January 2013 to December 2021*, statista.com/statistics/262176/market-share-held-by-mobile-operating-systems-in-china/ (showing Android and Apple accounting for over two thirds and one fifth of the Chinese mobile operating market, respectively).

34. *See* Figures 3A-3B below. I include tablets in the market for mobile device operating systems, as OEMs (the buyer of mobile operating systems) selling both tablets and smartphones prefer that the operating system work seamlessly across mobile device types. *See, e.g.*, Vangie Beal, *What Are Examples of Mobile Operating Systems?*, WEBOPEDIA (Apr. 5, 2022), webopedia.com/insights/mobile-os-and-different-types/. The OEM's demand for compatibility in operating systems across the device types is derived from the demand from consumers, who share the same preferences. *See* Part I.A.1.b, *supra*, discussing customer lock-in for operating systems. When performing econometrics and estimating damages, I also include App transactions on tablets in Google's transactional database. In any event, my opinions regarding Google's market power or common impact flowing from the Challenged Conduct do not turn on whether tablets are included or excluded.

35. *See, e.g.,* Jason Cohen, *iOS More Popular in Japan and US, Android Dominates in China and India,* PCMAG (Sept. 4, 2020), https://www.pcmag.com/news/ios-more-popular-in-japan-and-us-android-dominates-in-china-and-india ("The iPhone holds less than 20 percent of the market in Brazil, Nigeria, and India. A major factor to consider is price. The Apple iPhone is a high-end, high-price product that many in emerging economies balk at when comparing it with mid-range devices that use the Android operating system.").

36. Felix Richter, *The Smartphone Duopoly*, STATISTA (August 13, 2021), statista.com/chart/3268/smartphone-os-market-share/ ("Having started out as a multi-platform market, the smartphone landscape has effectively turned into a duopoly in recent years, after Apple's iOS and Google's Android crowded out any other platform including

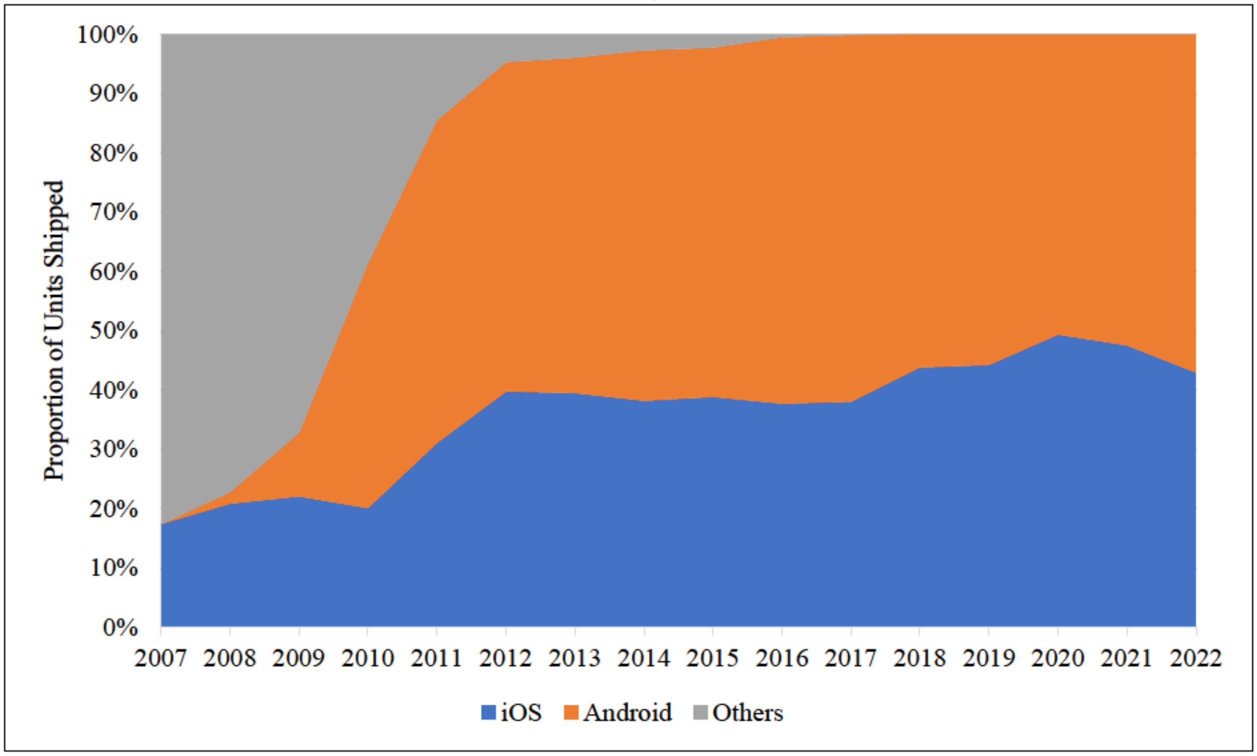
FIGURE 3A: MOBILE OS SHARE OF SMARTPHONE UNIT SHIPMENTS WORLDWIDE (EXCLUDING CHINA), 2007-2022



Source: IDC Worldwide Quarterly Mobile Phone Tracker. Appendix 8 displays comparable data for tablets. Data goes through 2022Q2.

Microsoft's Windows Phone, BlackBerry OS and Samsung's mobile operating system called Bada. . . Android devices accounted for 84.1 percent of global smartphone shipments in 2020, with Apple's iOS accounting for the remaining 15.9 percent. In 2010, the combined market share of Android and iOS was below 40 percent, with Nokia, Microsoft, BlackBerry and others sharing the rest of the market.").

FIGURE 3B: MOBILE OS SHARE OF SMARTPHONE UNIT SHIPMENTS
UNITED STATES, 2007-2022



Source: IDC Worldwide Quarterly Mobile Phone Tracker. Appendix 8 displays comparable data for tablets. Data goes through 2022Q2.

14. Similarly, the House Investigation of Competition in Digital Markets found that "[o]ver the past decade, once-strong competitors have exited the mobile OS market, and Google and Apple have built dominant positions that are durable and persistent. . . . other mobile OSs. . . make up less than 1% of the global mobile OS market."[37]

15. Google is the creator of the Google search engine. Google's business strategy has focused on providing free software and digital services,[38] which in turn collect information about users, ranging from personal identifying information like email and billing addresses, to areas of interest, to discrete preferences in products and services. Google does not sell the raw user information it collects,[39] choosing instead to monetize this information via its vast advertising business. Google provides advertising inventory including space on its Google Search result pages and its YouTube video platform as well as in the Play Store. It also provides tools used by both advertisers and online publishers in the purchase and sale of digital display advertising. Google's

37. *Investigation of Competition in Digital Markets: Majority Staff Report and Recommendations*, H.R. Subcomm. on Antitrust, Commercial and Administrative Law of the Comm. on the Judiciary [hereafter *Majority Staff Report*] (Oct. 6, 2020), at 101, judiciary.house.gov/uploadedfiles/competition_in_digital_markets.pdf?utm_campaign=4493-519 (chart showing iOS and Android market shares worldwide).

38. 2004 Founder's IPO Letter, From the S-1 Registration Statement, abc.xyz/investor/founders-letters/2004-ipo-letter/.

39. Google Safety Center, *Ads That Respect Your Privacy*, safety.google/privacy/ads-and-data/ ("We never sell your personal information.").

vast trove of user information, gathered across its range of free software products, including the Play Store, enhances the overall value of Google advertising products.[40]

16. In Google's earliest years, over 99 percent of its revenues were generated by its advertising business[41] and, in 2020, Google continued to generate over 80 percent of its total revenues from advertising.[42] Google's development of the Android operating system for mobile devices complements its advertising business because Google collects information about users, their devices, and their interactions with Apps every time an App is installed or updated on a Google Android device.[43] In addition, as consumers started to spend more time on mobile devices as compared to laptops and PCs, Google needed to ensure that Google's services reached mobile device users in order to collect user data. Accordingly, Google invested in Google Android so that these consumers would use its proprietary GMS suite of Apps and interfaces, allowing Google to bring its existing services and advertisements to more users, and to continue to collect valuable user data as consumers migrated to the use of mobile devices.[44]

17. When Google acquired Android in 2005, it was a little-known startup; Google launched the first public version of Android in 2008.[45] When Google acquired Android, Google valued the acquisition in terms of Android's contribution to Google's core advertising business—revenue from Apps (or In-App Content) was not an economically significant component.[46] Unlike

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40. *See, e.g.*, Megan Graham & Jennifer Elias, *How Google's $150 billion advertising business works*, CNBC (May 18, 2021), cnbc.com/2021/05/18/how-does-google-make-money-advertising-business-breakdown- html. *See also* Competition & Markets Authority, *Online platforms and digital advertising: Market study final report* (July 1, 2020) at 228, assets.publishing.service.gov.uk/media/5fa557668fa8f5788db46efc/Final_report_Digital_ALT_TEXT.pdf ("Google has tags (including as a third-party) on over 80% of websites and over 85% of Apps on the Play Store, which allows it to form a more complete picture of users' ad exposures, across its own properties and a substantial proportion of other non-Google websites.").

41. Google SEC Form 10-K, for the fiscal year ended Dec. 31, 2007, at 39, sec.gov/Archives/edgar/data/1288776/000119312508032690/d10k htm.

42. Google SEC Form 10-K, for the fiscal year ended Dec. 31, 2020, at 10, sec.gov/Archives/edgar/data/1652044/000165204421000010/goog-20201231 htm

43. Google Privacy & Terms, *Google Privacy Policy*, policies.google.com/privacy?hl=en-US.

44. Android, *The best of Google, right on your devices*, www.android.com/gms/ ("Google Mobile Services (GMS) is a collection of Google applications and APIs that help support functionality across devices.").

45. *See, e.g.,* John Callaham, *Google made its best acquisition nearly 17 years ago: Can you guess what it was?*, ANDROID AUTHORITY (May 13, 2022), androidauthority.com/google-android-acquisition-884194/ ("Back in 2005, everyone thought of Google as just another ad-supported search company. However, nearly 17 years ago, on July 11, 2005, the company made what we think was its best acquisition to date. It purchased a little startup company called Android. At the time, there was no "Google buys Android" news headline to reveal the move; that would come a little later. Of course, we all know the deal was a great success — this website wouldn't exist if it wasn't. Using the skills of its new Android team members, Google spent the next three years developing an operating system for mobile devices. This culminated in the launch of the first public version of Android in 2008, released on the T-Mobile G1/HTC Dream. Today, Android is the most popular mobile OS in the world by a large margin.").

46. Deposition of Android co-founder and former Google executive Rich Miner (Sep. 8, 2022) [hereafter Miner Dep.] 31:15-32:23; 36:24-37:12. *See also* Miner Dep. 52:23-55:14 (Google calculated the valuation of Android based on search and local search services, not on revenue from Apps). *See also* GOOG-PLAY4-000775391 (showing Android revenue projections in the lead-up to acquisition by Google; the Apps business, referred to as "Key authority management," was projected to reach $1.5 million at most, or just 2.5% percent of total Android revenue). *See also* GOOG-PLAY-001432366 (as of 2009, the "[l]ong-term strategy is to monetize the Android platform through ads once we have volume"); GOOG-PLAY-001337211 at -215 (2009 Android P&L statement projecting 2013 revenues of

iOS, the Android operating system is allegedly "open source," meaning that anyone can inspect, modify, or enhance the source code to manipulate the software. But while an open-source version of Android exists, the vast majority of OEMs manufacture Android OS devices that meet Google's compatibility requirements and are preloaded with a proprietary suite of Apps and interfaces that Google designed specifically for mobile devices ("Google Mobile Services" or "GMS").[47] Manufacturers who wish to use Android equipped with the full functionality and important Google application interfaces must sign a licensing agreement with Google. For purposes of this report, I refer to devices that are pre-loaded with the GMS suite of Apps as ("Google Android"). As seen in Figure 4 below, Google Android devices make up virtually all non-iOS smartphones outside of China. Google Android devices must comply with the Android Compatibility Program, in which Google "defines technical details of the Android platform and provides tools for OEMs to ensure developer applications run on a variety of devices."[48] To be granted the right to use Google Android, OEMs must enter into contracts preventing them from selling any "forked" Android-based devices that do not meet Google's compatibility standards.[49] OEMs are also required to sign contracts that leverage Google's GMS suite and APIs to guarantee that the Play Store is preinstalled on the OEM's device and prominently displayed to the user.[50] In addition, the Android name and logo are "not part of the assets available through the Android Open Source Project."[51] As seen in Figure 4 below, smartphones with Google Android account for the vast majority of all smartphones sold with licensed operating systems, both in the U.S. and worldwide. As seen in Appendix 8, market shares for tablets are similar, although the Windows OS has a small share.

$1.26 billion from ads and $282 million from Apps); GOOG-PLAY-011612978 at -985 (statement of Android co-founder and former Google executive Rich Miner to the European Commission on behalf of Google, explaining that "[s]earch is core to Google's business…Google needed to ensure that customers could access its apps and services, including those that we can monetize, in order to support further investments in the ecosystem"). *See also* GOOG-PLAY-001055695 at -697 (Android founder Andy Rubin in October 2009: "The reason Google is building Android is so it can benefit from the advertising revenue generated by consumers using their phones to do searches[.]")

47. Android, *The best of Google, right on your devices*, android.com/gms/ ("Google Mobile Services (GMS) is a collection of Google applications and APIs that help support functionality across devices.").

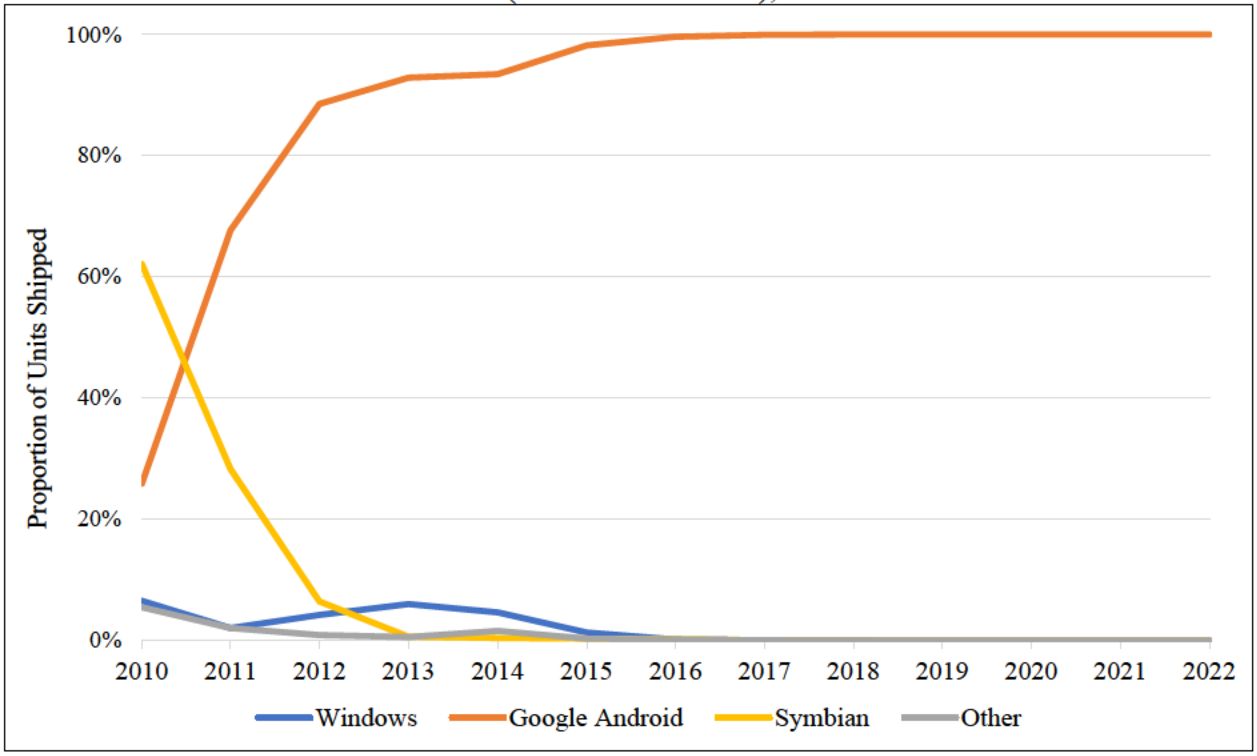
48. Android, *Android Compatibility Program Overview*, source.android.com/docs/compatibility/overview.

49. These contracts, referred to as Anti-Fragmentation Agreements or (more recently) Android Compatibility Commitments, are discussed further in Part IV.A.2 below.

50. These contracts, referred to as Mobile Application Distribution Agreements, are discussed further in Part IV.A.2 below.

51. Android, *Brand guidelines*, developer.android.com/distribute/marketing-tools/brand-guidelines ("The 'Android' name, the Android logo, the 'Google Play' brand, and other Google trademarks, are property of Google LLC and not part of the assets available through the Android Open Source Project.").

FIGURE 4: LICENSED MOBILE OS SHARE OF SMARTPHONE UNIT SHIPMENTS WORLDWIDE (EXCLUDING CHINA), 2010-2022



Source: IDC Worldwide Quarterly Mobile Phone Tracker. Appendix 8 displays comparable data for tablets. Data goes through 2022Q2.

18. Thus, although an OEM could theoretically attempt to launch a smartphone using only a "forked" version of Android, the market outcomes shown above indicate that doing so does not make economic sense. An OEM attempting to do so would risk losing access to all or virtually all of the market(s) that it currently serves outside of China. Record evidence indicates that the vast majority of top Android developers depend on one or more proprietary Google APIs, which are only available through Google Android.[52] Google's website cautions developers against using Android's open-source geolocation software, informing developers that they are "strongly encouraged" to use the Google Android version instead.[53] As one industry analyst put it, "Google has worked to make Android functionally unforkable."[54]

52. GOOG-PLAY-000457086.R at -099.R (Google slide deck from late 2015 stating that hundreds of thousands of Apps, including approximately about 80 percent of the top 1,000 Android developers, use at least one proprietary Google API); GOOG-PLAY-000128863.R at -876.R (same statement in slide deck dated May 2019).

53. Android, *android.location*, developer.android.com/reference/android/location/package-summary ("This API is not the recommended method for accessing Android location. The Google Location Services API, part of Google Play services, is the preferred way to add location-awareness to your app. It offers a simpler API, higher accuracy, low-power geofencing, and more. If you are currently using the android.location API, you are strongly encouraged to switch to the Google Location Services API as soon as possible.").

54. *Neither Microsoft, Nokia, nor anyone else should fork Android. It's unforkable.*, ARS TECHNICA, (February 8, 2014), arstechnica.com/information-technology/2014/02/neither-microsoft-nokia-nor-anyone-else-should-fork-android-its-unforkable/. *See also* Ron Amadeo, *Google's iron grip on Android: Controlling open source by any means*

19. The functionality and user enjoyment derived from a mobile device is highly dependent upon the range and quality of apps available on it. In addition to producing a mobile operating system, Google has created a distribution channel for delivery of Android-compatible Apps developed by third parties, and it has developed its own universe of Apps, for Google Android. Indeed, Google has developed (or acquired) some of the most popular Android- and iOS-compatible apps, including Google Search, Google Maps, Chrome, YouTube, and Gmail.

20. When purchased by the consumer, mobile devices come pre-loaded with a variety of Apps pre-positioned on the device's "home screens," each of which is accessed by swiping your thumb. The first screen is known as the "default home screen." Because pre-loaded Apps—whether on the home screen or otherwise—are automatically available to all the users who purchase the device, App developers would find it advantageous to have their Apps pre-installed by the OEMs (though, as detailed below, preinstallation is not an option for the majority of developers).[55] Similarly, the placement of an App in a prominent place on a device's home screen makes it more likely that consumers will open and engage with it, meaning the initial icon placement can strongly influence an App's overall usage and popularity.[56] Pre-installation and default placement of pre-loaded Apps are significant factors in determining an App's adoption by consumers and the App's ultimate success. Behavioral economists have shown that consumers are more likely to accept an option when it is offered as a default. For example, individuals are more likely to contribute to 401(K) retirement plans when enrollment is automatic, as opposed to requiring employees to opt into the plan.[57] According to a Google Play Competitive Usage Survey, the vast majority (81 percent) of US respondents learned about the Play Store because it "Came preinstalled on my phone," while only eight percent of US respondents learned about the Play Store when they "Discussed it with a friend or family member[.]"[58]

21. In addition to proprietary Google Apps and Apple apps, a broad universe of apps are created for both operating systems by independent software developers. However, the Android and Apple operating systems are not compatible, meaning that software developers must create different versions of their apps to operate on each system. For the vast majority of developers, expending the time and resources necessary to create an app for a particular operating system depends upon the number of consumers using a device running that operating system. Given the

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necessary, ARS TECHNICA (July 21, 2018), arstechnica.com/gadgets/2018/07/googles-iron-grip-on-android-controlling-open-source-by-any-means-necessary/ ("Android is open—except for all the good parts."). *See also* GOOG-PLAY-004338386 at -388—389 (2009 internal chat transcript in which one Google employee notes that the "'…reason the open-source builds suck is BECAUSE THEY'RE MISSING THE PROPRIETARY BITS;" to which another employee responds by observing "forget 'evil' – it's harmful," and a third employee responds that they are "not sure it's possible to build a working phone from Android without at least some of [Google's] proprietary stuff . . . which sort of undermine[s] the whole AOSP situation."). AOSP stands for Android Open Source Project. *See* source.android.com/.

55. *See, e.g.,* GOOG-PLAY-010801568 at -570 [redacted] GOOG-PLAY-001404176 ("Preloading remains valuable to users, and hence OEMs, despite full unbundling because most users just use what comes on the device. People rarely change defaults.").

56. *See, e.g.,* GOOG-PLAY-006355073 ("Fortunately, we'll always have the placement / pre-install advantage which is 90% of the battle.").

57. Brigitte Madrian & Dennis Shea, *The power of suggestion: Inertia in 401 (k) participation and savings behavior* 116(4) THE QUARTERLY JOURNAL OF ECONOMICS 1149-1187 (2001). *See also* RICHARD THALER & CASS SUNSTEIN, NUDGE: IMPROVING DECISIONS ABOUT HEALTH, WEALTH, AND HAPPINESS (Yale University Press 2008).

58. GOOG-PLAY-001886111.R at -119.R.

reach of Google Android and Apple iOS devices, most large developers currently create and provide apps for both systems.[59]

22. When a consumer makes an initial purchase of a mobile device, Google Android devices (manufactured by OEMs such as Samsung) and Apple devices may compete with one another for some users, but this competition is limited significantly by differences in pricing, features, and customer bases.[60] Moreover, once a consumer has elected to purchase a mobile device using either Google Android or Apple iOS, a range of factors effectively lock them in to that ecosystem, both for that device and even when purchasing replacement devices in the future. For example, because the two ecosystems are incompatible, paid apps cannot be transferred by a user from one system to another. Users may incur investments in time and money to identify, purchase, and install apps and content, including games, music, and videos, that may have to be repurchased or reinstalled upon switching operating systems.[61] Users may also risk the loss of important data such as contacts, calendars, and photos.[62] Economic analysis and standard economic tests for market definition show that the market for Android Apps and for the distribution of those Apps is distinct and separate from the market for app distribution on Apple's proprietary iOS.[63]

Overview of Analysis

23. Google Android has attained a share of over 99 percent of the market for licensed mobile device operating systems outside of China.[64] For OEMs that have manufactured mobile devices, Google Android is the licensed operating system of choice. These OEMs cannot install Apple's iOS on their mobile devices because Apple does not license its operating system, preferring to manufacture its own devices. And since Apps are neither interoperable nor transferable across the Android and iOS systems, there exist distinct markets for app distribution within each of the two operating systems. Once a consumer has selected the Google Android mobile device ecosystem through the purchase of an initial device, the consumer is "locked-in" to the Google Android ecosystem, and Apple does not meaningfully constrain Google's pricing for the distribution of Android Apps.[65]

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59. *See, e.g.,* Appendix 9, showing that 99 of the top 100 Apps in the Play Store are also available in the Apple App Store.

60. *See* Part I.A.1.b below (discussing customer lock-in).

61. *Id.* Apple does not guarantee even that all free Apps will be ported. *See* Apple, *Move from Android to iPhone, iPad or iPod touch*, support.apple.com/en-gb/HT201196 ("Here's what gets transferred: contacts, message history, camera photos and videos, photo albums, files and folders, accessibility settings, display settings, web bookmarks, email accounts and calendars. If they're available on both Google Play and the App Store, *some of your free Apps* will also be transferred. After the transfer is complete, you can download any free Apps that were matched from the App Store.") (emphasis added). Likewise, Google's own Pixel switching service cannot transfer paid Apps from iOS. *See* GOOG-PLAY-004147888 at -897; Pixel Phone Help, *Transfer Data from an iPhone to a Pixel,* support.google.com/pixelphone/answer/7129740#what_doesnt_copy&zippy=%2Cwhat-wont-copy-during-setup ("What won't copy during setup" includes "Paid Apps" and "Unpaid Apps not matched on the Play Store").

62. *See* Part I.A.1.b below (discussing customer lock-in).

63. *See* Parts II.A and III.A below.

64. *See* Figure 4 above.

65. *See* Part I.A.1, *infra*. Although consumers can switch to different ecosystem when purchasing a new phone, competition in that dimension is insufficient to constrain Google from imposing anticompetitive take rates on developers.

24. To pre-install the Google Mobile Services suite of Apps and interfaces on their own devices, and to qualify for millions of dollars in search-related revenue sharing payments from Google, OEMs must enter into a licensing agreement with Google. The Play Store, formerly known as Android Marketplace, is part of Google Mobile Services and is an "App store" that provides consumers with a range of Apps[66] they can download and use on their Android devices. An App store is a two-sided platform: on one side, developers offer Apps for download and purchase, while on the other side, consumers search for and purchase Apps to download to their devices. Such two-sided platforms are characterized by what economists call "indirect network effects," meaning that the value of the platform to the users on one side is increased when there are more users on the other side of the platform. Here, the value of an App store to consumers is increased when more developers offer more Apps on the platform.[67] In turn, the value of an App store to developers is increased when there are more consumers utilizing the store to search for and download Apps. Indeed, Google's internal documents and depositions taken to date reveal that consumer reach—the number of consumers utilizing an App store for initial downloads and purchases—is a critically important factor in the Play Store's attractiveness to developers.[68]

25. In October 2008, when Google launched its Android Market App store, Google's primary goal was to ensure adoption of Google Android by the array of OEMs and carriers that previously provided their own branded devices with differentiated software and operating systems[69]—and by extension, consumers choosing Android devices over Apple and Blackberry devices. By diverting a significant portion of the funds earned from its take rate charged to developers as well as advertising revenues to carriers and certain OEMs, Google dissuaded those carriers and OEMs from establishing or pre-installing on these devices any rival App stores that might have competed with the Play Store.

26. Although Android App developers have consistently kept 70 percent of the proceeds of all App sales and the sale of In-App Content, the distribution of the remaining 30 percent has changed over time. As shown in Figure 1 below, in earlier years, before Google acquired monopoly power in the Android App Distribution Market, Google retained, at most, five percent of revenues from developers' sale of Apps or In-App Content, diverting 25 percent of developer revenue largely to carriers and sometimes to OEMs (for some devices abroad).[70] This

66. Apps must be configured to run on a device's operating system as "native Apps," which are Apps that run directly on a device's OS; this means that they must be specifically tailored for each OS. In contrast to web-based Apps and game-streaming services, native Apps do not necessarily need an Internet connection to function after the App has been installed on a user's device. *See also* Emily Stevens, *What is the Difference Between a Mobile App and a Web App?*, CAREERFOUNDRY, (September 7, 2021), careerfoundry.com/en/blog/web-development/what-is-the-difference-between-a-mobile-app-and-a-web-app/.

67. Google's documents recognize this. *See, e.g.,* GOOG-PLAY-004490904.R at -905.R (emphasizing "the criticality of a 3P dev ecosystem to succeed, and the degree of difficulty of attracting & retaining 3P developers.").

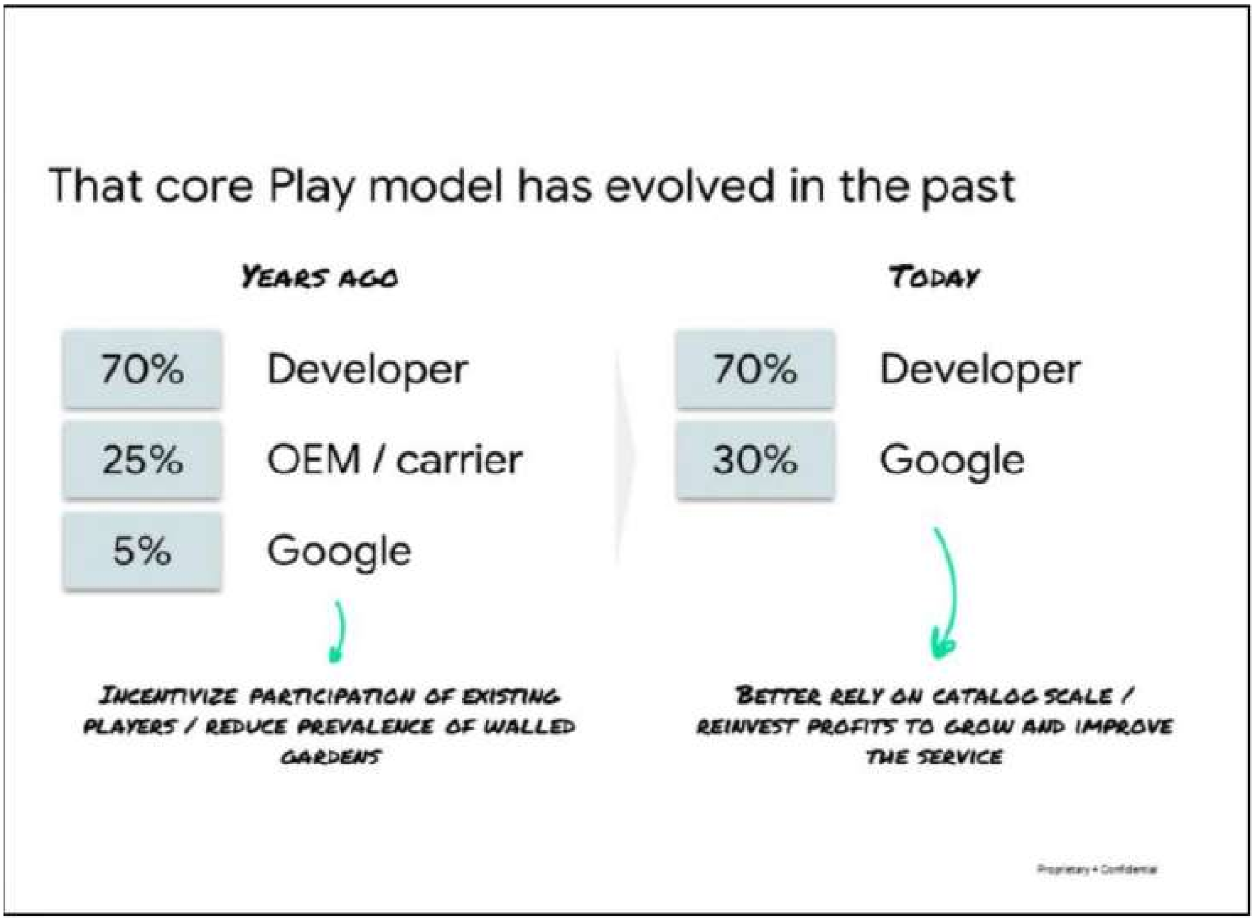
68. GOOG-PLAY-007317611 at -614-615 (Report of Dr. Itamar Simonson, Feb. 8, 2016) ("[T]he demand (or expected demand) for and profitability of developing applications for a platform are by far the most important drivers of decisions to develop applications for a platform."). *See also* Deposition of Lawrence Koh (Dec. 9, 2021) [hereafter Koh Dep.] at 321:19-323:1; 324:6-12 (the developers [redacted] and [redacted] decided not to distribute on other Android App platforms because "there was engineering work required for us to be able to utilize those services" and because of the size of Play's distribution platform across Android devices).

69. *See* Part IV.A.1, *infra*.

70. Google entered revenue-sharing agreements with OEMs and carriers based on the party that owned the "client ID" for a given phone. In the United States, the carriers control the device's client ID in nearly all cases, and

created an incentive which would entrench the Play Store on more mobile devices and discourage the initiation and success of competing App stores. Google's witnesses have testified that this allocation resulted in a loss for Google on a per-transaction basis,[71] a loss Google absorbed to convince carriers and other potential competitors not to compete in the Android App Distribution Market. Once the Play Store attained significant penetration and user adoption, Google reduced the carriers' share of the take rate and ultimately terminated its revenue-sharing agreements with the mobile carriers.

FIGURE 5: SPLIT BETWEEN GOOGLE AND MOBILE CARRIERS/OEMS OVER TIME



Source: GOOG-PLAY-000443763.R at -722.R.

The Android App Distribution Market

27. The Play Store is Google's two-sided platform for bringing together developers and consumers, allowing developers to sell and distribute Apps and consumers to purchase Apps for use on their Android devices. In addition to providing matchmaking between consumers and developers, other functions in the Android App Distribution Market include, but are not limited

accordingly received revenue sharing. GOOG-PLAY-007847148 (Deposition of Jamie Rosenberg (July 14, 2020) in *In re Google Antitrust Litigation*) [hereafter Rosenberg Dep.] at 126:10-129:9.

71. Deposition of Eric Chu (Dec. 20, 2021) [hereafter Chu Dep.] at 84:10-88:7 ("As I said, I was focusing on locking down 70 percent developers, 25 percent for carriers. I also said that I know factually at 5 percent Google would be losing money on both the transaction and also running the store.").

to, auto-updating and storage. With the exception of China, where the Play Store is blocked,[72] "Apple and Google control more than 95 percent of the [a]pp store market share through iOS and Android…The [a]pp economy was built on these two platforms[.]"[73] Due in part to the massive installed base of Android mobile devices, the Play Store accounts for more than three times as many downloads as the Apple App Store worldwide—despite the Play Store's absence from China.[74]

28. The Android App Distribution Market is a relevant product market that is distinct, not only from Apple's iOS app distribution market, but also from the markets for web-based apps and distribution channels for applications for PCs or gaming consoles. Given the widespread distribution of the Play Store on Google Android devices throughout the world, developers of Android-compatible Apps, wherever they are located, have strong incentives to list their Apps for distribution on the Play Store. The global reach of the Play Store and the developers who seek to distribute their Apps through it, thus makes the relevant geographic market for the Android App Distribution Market global, except for China, where the government prefers Chinese providers of both mobile devices and operating systems.[75]

29. Direct and indirect evidence establishes that Google has market power in the Android App Distribution Market. Google's 30 percent take rate is high relative to competitive benchmarks, yet the vast majority of Apps are downloaded through the Play Store. As a two-sided platform, the Play Store benefits from indirect network effects, which serve to entrench its market share with developers. Given the Play Store's reach with consumers gained and maintained through the Challenged Conduct, which has also substantially foreclosed alternative channels for Android Apps, developers effectively must list their Apps on the Play Store and agree to its restrictive conditions, which in turn act as substantial barriers to entry for effective competition from rival App stores.

30. Google has provided inducements, imposed a variety of restrictions, and erected various technological barriers to substantially foreclose rival App stores and the direct downloading of Apps. It has done so to achieve and maintain its market power in the Android App Distribution Market. More specifically, Google has engaged in the following conduct in the Android App Distribution Market:

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72. VPNDada, *How to Access Google Play Store in China*, vpndada.com/access-google-play-store-china/ ("If you buy an Android phone in China today, you won't find the Google Play App store pre-installed on that phone. Instead, depending on the brand of the phone, it will come with some other App stores, mostly likely one offered by a Chinese company.").

73. David Curry, *App Store Data (2022),* BUSINESS OF APPS, (Jan. 11, 2022), businessofApps.com/data/app-stores/ ("Outside of China, Apple and Google control more than 95 percent of the App store market share through iOS and Android, respectively. . . The App economy was built on these two platforms, which have expanded their offerings to include Apps for consumers and every type of business.").

74. *See, e.g.,* Sensor Tower, *2021 – 2025 Mobile Market Forecast,* (2021) at 7, go.sensortower.com/rs/351-RWH-315/images/Sensor-Tower-2021-2025-Market-Forecast.pdf (showing 109 billion Play Store App downloads worldwide in 2020, compared with 34 billion App downloads in the Apple App Store).

75. GOOG-PLAY-004253884 at -894 ("Samsung Leads in All Retail Driven Markets except China") (chart shows Apple and Samsung shares in different countries, with the Chinese market dominated (60 percent) by local OEMs).

a. *Financial Inducements*: Google achieved its power in the Android App Distribution Market by making payments that incentivized carriers (and OEMs) to distribute Google Android mobile devices and dissuaded (and in some cases prevented) them from developing, promoting, or offering alternative App stores, including their own stores. Google was willing to operate the Play Store at a loss to achieve these purposes but, once power was achieved, Google dramatically reduced or eliminated these payments.

b. *Bundling of Apps and APIs*: Google requires OEMs to pre-install and prominently place the Play Store on all Google Android devices as a contractual condition of licensing GMS, which includes Google's most popular Apps, including Google Maps, YouTube, Chrome, Google Search, and Gmail. OEMs must also install this bundle of Apps to gain access to crucial programming interfaces necessary for many common Android Apps to properly function. The Play Store's prominent position inhibits competition from competing App stores.

c. *Anti-steering Restrictions*: Google's agreements with App developers prohibit developers from steering users within the App to other App stores, platforms, or websites to purchase or download Apps.[76]

d. *Tie of YouTube, Google Search, and Play Store Advertising to the Play Store*: App developers' access to valuable advertising opportunities on YouTube and Google Search is only available for Apps distributed through the Play Store.

e. *Substantial Financial Inducements to Large Developers in Return for MFN Provisions*. Faced with the prospect of potential competition from other App stores (including the potential for large developers to create their own App stores), Google offered large financial inducements to large developers in order to secure contractual commitments that they would not provide unique content to Google competitors. Google called this program "Project Hug," and it was designed to "mitigate" the risk of competition.

f. *Revenue Agreements in Exchange for Exclusivity Provisions:* Google's recent agreements with OEMs require OEMs to provide exclusivity for the Play Store in exchange for millions of dollars in revenue sharing payments.

g. *Exclusion of Facebook from App Distribution*: I understand that Google considered erecting certain technical roadblocks involving installation or update permissions in order to impede Facebook's ability to deploy a competing App store. I further understand that there is evidence that Google has thus far refrained from doing so after assurances from Facebook that it did not intend to compete with Google in third-party app distribution. I also understand that

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76. *See* Google Play Payments Policy, §4, https://support.google.com/googleplay/android-developer/answer/9858738?visit_id=637994598201252840-4239604614&rd=1.

Google has attempted to prevent (and may have succeeded in preventing) App distribution through the Facebook news feed by ensuring that Facebook uses Google Play's technologies for such distribution. I am not opining on the existence of such agreements. Nevertheless, if there were such agreements, they would very likely have generated anticompetitive effects.

h. *Technical Barriers*: Google imposes default settings and warnings that make it unnecessarily difficult for users to download rival App stores and Apps from rival App stores or from developer websites, and auto-updating functionality is limited to the Play Store and certain pre-installed Apps.

31. Google's conduct suppresses the development of competing App stores and the distribution of applications outside of Google Play. Google's conduct has substantially foreclosed critical distribution channels for competitors, raised barriers to entry in the Android App Distribution Market, and prevented the use of alternative In-App Aftermarket providers. For example, multi-homing—the use of alternative App stores on the same device—would occur more extensively in the absence of Google's restraints. In a more competitive world, steering by altering the relative price of initial downloads of Apps would allow developers to direct consumers to lower-priced alternatives, including direct downloads from their own websites or competing App stores that charge lower take rates.

32. In the absence of Google's conduct, competition would have led to lower prices. With a combination of multi-homing and steering, developers could charge a lower price for Apps to consumers who would download Apps from a lower-cost App platform or website. This in turn would exert competitive pressure on Google to lower its own take rate.

The Aftermarket for Services in Support of Consummating Purchases of In-App Content

33. Following the download and installation of an App, developers may offer to the consumer digital content related to the App (In-App Content). The matchmaking services offered by Google in the Android App Distribution Market are distinct from the services offered in support of consummating purchases of In-App Content. The In-App Aftermarket involves transactions between developers and sellers of services, including payment processing, record keeping, and unlocking of content, needed to consummate a purchase of In-App Content. From the developer's perspective, certain functions are needed for a consumer to be able to purchase In-App Content, including billing (also present in the Android App Distribution Market) and unlocking the In-App Content on the user's phone (not present in the Android App Distribution Market). Accordingly, the developer's demand for these services in the In-App Aftermarket is derived from the consumer demand for In-App Content. Unlike the two-sided Android App Distribution Market, the In-App Aftermarket is one-sided. Indirect network effects are not present in the In-App Aftermarket. While the App developer delivers the In-App Content, because of Google's requirements an App developer cannot complete the transaction without using Google's In-App Aftermarket Service, Google Play Billing ("Google Play Billing" or "GPB"). By forcing developers to complete transactions through Google Play Billing, Google has effectively tied the In-App Aftermarket to the Android App Distribution Market and forced developers who distribute an App to a consumer through Google to forever use Google as a middleman for the consumers' purchase of In-App Content for such an App. Absent this tie-in, developers could either provide or engage third parties to provide in the In-App Aftermarket the services now provided by Google.

34. Once an App is purchased and downloaded from the Play Store, Google need not play any role in the In-App Aftermarket. I understand that Plaintiffs' technical expert, Professor Douglas Schmidt, has found that, although Google inserts itself into the In-App Aftermarket by requiring that developers use Google Play Billing, there is no technical justification for requiring developers to use Google Play Billing.[77] Similarly, while Google requires that every App downloaded through the Play Store utilize the services that Google has included in its Google Play Billing product for the sale of In-App Content, there are numerous alternatives that can provide similar features at a lower cost to developers and ultimately consumers. The economic evidence demonstrates separate demand for In-App Aftermarket services.[78]

35. Google maintains market power in the In-App Aftermarket by requiring developers to use Google Play Billing to support the purchase of all In-App Content. Google utilizes Google Play Billing to impose a take rate generally of 30 percent—the same take rate it commands in the Android App Distribution Market—on all purchases of In-App Content for that App, forever. The In-App Aftermarket is a distinct relevant market, and in the but-for world, developers could select from among many potential competitors (or deploy a vertically integrated solution) to support the purchase of In-App Content. This is evidenced by Google's prohibition on developer steering of consumers to outside channels, the ability of more powerful developers to bypass Google Play Billing, Google's efforts to incentivize these developers to transact through Google Play Billing, and by separate demand for services in the In-App Aftermarket. The geographic In-App Aftermarket is global, except for China, as third party In-App Aftermarket service providers could provide cross-border global services.

36. Direct and indirect evidence establishes Google's market power in the In-App Aftermarket. Google's standard 30 percent take rate is high compared to rates charged by potential competitors, yet [redacted] percent of all developers offering In-App Content utilize Google Play Billing by virtue of Google's restraints.[79] Moreover, Google routinely discriminates in price among developers, not requiring those selling physical goods through an App to utilize Google Play Billing, and, more recently, reducing its take rate on subscription sales or sales by smaller

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77. This conclusion is corroborated by the fact that Google does not require developers selling physical goods or services (such as Uber) to use Google Play Billing; Google lacks sufficient market power to impose the Aftermarket Tie-In on these developers. It is further corroborated by the fact that, in compliance with local legislation, Google now allows developers selling digital goods in South Korea to use alternatives to Google Play Billing. *See, e.g.,* Play Console Help, *Changes to Google Play's billing requirements for developers serving users in South Korea*, support.google.com/googleplay/android-developer/answer/11222040 ("As a result of recent legislation, we are now offering all developers the ability to offer an alternative in-app billing system alongside Google Play's for their mobile and tablet users in South Korea.").

78. *See* Part III.A.2 below.

79. Record evidence indicates Google recognized early on that its 30 percent take rate was difficult to justify. *See, e.g.,* GOOG-PLAY-004338990 (Internal December 2009 e-mail seeking "[e]xact articulation of under what circumstances transactions *we* [Google] now solely take 30% . . . I don't have any idea how much money we think this will make for us, but it will cost us a lot of good will. Further, if Android is here to increase phone usage and thus web usage and thus drive ad revenue, we need to give developers every penny we reasonably can. . . With Passion we are apparently keeping 30% on all transactions, I can't imagine transaction processing costs us that much. Why don't we take this opportunity to let developers keep more revenue? I don't know why this change has been made and there is deafening silence from those who know. The only reasoning I can come up with makes no sense, which is even worse than reasoning I disagree with.").

developers, reflecting the fact that Google faces a downward-sloping demand curve among developers, a hallmark of market power.[80]

37. Google has maintained its market power in the In-App Aftermarket by imposing a variety of restrictions and offering targeted financial incentives. More specifically, Google has engaged in the following conduct in the In-App Aftermarket:

a. *Linking Play Store Access*: A developer can offer its App for sale or distribution through the Play Store, which has monopoly power in the Android App Distribution Market—only if the developer agrees to exclusively use Google Play Billing for all subsequent sales of In-App Content.

b. *Anti-Steering Restrictions*: Google contractually prohibits developers from steering customers within the App to alternative distribution and payment processing outlets for purchasing In-App Content and prohibits them from even using any customer information the developer learned through the Play Store.[81]

c. *Targeted Incentives*: Google provides large monetary incentives and advertising packages to ensure that those developers that have the resources to create alternative billing systems use GPB exclusively.[82]

38. For ease of exposition, I refer to this collection of restraints as the "Aftermarket Restrictions," and I refer to the first restriction (a) as the "Aftermarket Tie-In" or "Tie-in."[83] In the absence of the Aftermarket Restrictions, competition in the In-App Aftermarket would be robust. Developers would be able to select their own suppliers in the In-App Aftermarket from an array of competitive options and could steer consumers towards lower-priced alternatives.

The Impact of Google's Anticompetitive Conduct on Consumer Plaintiffs

39. Google's anticompetitive restrictions in the Android App Distribution Market and in the In-App Aftermarket have impaired competition in both markets. These anticompetitive restrictions have damaged U.S. Consumers by raising the prices of paid Apps and In-App Content. Absent Google's restrictions and anticompetitive conduct, competition in the distribution of applications would materialize, and developers would likewise have a choice of how to transact their In-App Content with their own users. The benefits to consumers resulting from competition could take different forms. I use a two-sided platform model with multi-homing to show that, in the absence of restraints in the Android App Distribution Market, Google would be compelled to

80. Firms that lack market power, by contrast, face a horizontal demand curve, which means they cannot influence the market price, or restrict output by raising prices.

81. *See* Google Play Payments Policy, §4, https://support.google.com/googleplay/android-developer/answer/9858738?visit_id=637994598201252840-4239604614&rd=1; GOOG-PLAY-000053875 at -876 (Google Play Developer Distribution Agreement, effective as of Nov. 17, 2020, which provides, "You may not use user information obtained via Play to sell or distribute Products outside of Google Play").

82. When employed by a firm with monopoly power, a loyalty rebate or bundled loyalty discount can foreclose rivals and thereby serve as a restraint on trade. *See, e.g.*, Patrick Greenlee, David Reitman, and David S. Sibley, *An antitrust analysis of bundled loyalty discounts*, 26 INT'L J. INDUS. ORG. 1132, 1135, 1137-38 (2007).

83. The Aftermarket Tie-In can also be analyzed through the lens of exclusive dealing. *See, e.g.,* Kevin Caves & Hal Singer, *Assessing Bundled And Share-Based Loyalty Rebates: Application To The Pharmaceutical Industry* 8 JOURNAL OF COMPETITION LAW & ECONOMICS 889, 892-895 (2012).

lower its take rate from developers. I show that a portion of the savings to developers from a take rate reduction would be reflected in lower consumer prices.

40. Next, I use the Discount Model to demonstrate how Google would respond to greater competition by increasing direct consumer discounts. I also calculate aggregate damages using the Amazon Appstore as a benchmark. The Amazon Appstore operates in the same market as the Play Store, distributing Apps on Google Android devices. But unlike the Play Store, the Amazon Appstore lacks monopoly power, and competes on the merits by offering direct customer discounts of [redacted] percent to those who access the Amazon Appstore on Google Android devices. The Play Store's ability to offer comparatively meager customer discounts of less than [redacted] percent without losing significant market share to Amazon reflects the market power conferred by the Challenged Conduct.

41. The remainder of the report is organized as follows. In Part I, I demonstrate that there is a relevant antitrust market for licensed mobile operating systems, and I demonstrate that Google has monopoly power in that market. In Parts II and III, I demonstrate that the Android App Distribution Market and the In-App Aftermarket are distinct relevant antitrust markets and that Google wields monopoly power in each. In Part IV, I describe the restraints imposed by Google in the Android App Distribution Market, and I demonstrate that these restraints have anticompetitive effects and substantially foreclosed competition. In Part V, I perform a similar analysis for the In-App Aftermarket. In Part VI, I demonstrate the anticompetitive injury flowing from Google's anticompetitive conduct in the relevant markets at issue. In Parts VII and VIII, I estimate aggregate damages to U.S. Consumers, and I demonstrate how injury and damages are calculated for individual U.S. Consumers.

I. GOOGLE'S MONOPOLY POWER IN THE MARKET FOR LICENSED MOBILE OPERATING SYSTEMS

42. My economic analysis encompasses several relevant antitrust markets. The first is the relevant market for licensed mobile operating systems, defined as mobile OSs that are available to be licensed to entities other than the owner of the mobile OS. Mobile device OEMs must either develop their own operating system or license an operating system from a third party. Apple is the only significant device manufacturer to develop and maintain its own operating system, iOS, which works exclusively on Apple devices. For all other OEMs, Google is the dominant provider of licensed mobile device operating systems. Outside of China, Google Android accounts for virtually 100 percent of all licensed mobile operating systems.[84] Google dominates this market through its control of the Google Android operating system.

43. Many of the same economic factors that inform the definition of the relevant antitrust market for licensed mobile operating systems also inform the other two relevant antitrust markets at issue here. The barriers to substitution between iOS and Google Android, analyzed in Part I.A.1 below, also confer market power to Google in the Android App Distribution Market and the In-App Aftermarket. The same holds true for the inability of technologies such as PCs and gaming consoles to discipline Google's market power, reviewed in Part I.A.4 below.

84. *See* Figure 3A above.

A. There is a Distinct Relevant Antitrust Market for Licensed Mobile Operating Systems

44. A (not so) hypothetical monopolist over Google Android could profitably exercise market power over OEMs, due to a lack of economically viable competing OSs to whom the OEMs could switch in response to an exercise of market power by Google Android.[85] As detailed below, Google's monopoly in licensed mobile operating systems is well-established and is demonstrated through both direct and indirect methods.

1. Apple's iOS Is Not In the Relevant Antitrust Market for Licensed Mobile Operating Systems

a. OEMs Cannot License Apple's iOS

45. Apple does not license its iOS to any other OEM. Thus, from an OEM's vantage, iOS is not a substitute for licensed mobile operating systems. In terms of the test for market definition in the *Horizontal Merger Guidelines*, a small, but significant, non-transitory increase in price (a "SSNIP") by a hypothetical monopolist of licensed operating systems could not induce any OEM to install iOS instead, as Apple will not grant such a license.[86]

b. Customer Lock-In, Distinct Pricing and Features, and Distinct Customer Bases Insulate iOS and Google Android from Head-To-Head Competition

46. Consumers are the ultimate source of demand for smartphones, and anticompetitive conduct in the market for mobile OSs is harmful to consumers. In a competitive market, consumers might respond to an exercise of market power by Google Android by switching to iOS. In reality, consumers face a range of barriers that make this impracticable, as detailed in this section.

47. Consumers cannot switch between iOS and Android OSs without switching devices. For example, a user with an Apple iPhone cannot obtain Apps from the Play Store (or from any other Android App store), and a user with an Android phone cannot download Apps from

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85. *See, e.g.,* Department of Justice & Federal Trade Commission, *Horizontal Merger Guidelines* (2010), §4.1.1.

86. The court in *Epic v. Apple* found that the relevant market for Epic's gaming-centric complaint was the "mobile gaming market," which included iOS and Android mobile devices. There the court followed the factors from *Newcal Indus., Inc. v. Ikon Office Sol.*, 513 F.3d 1038, 1049-50 (9th Cir. 2008), which are divorced from economic teachings, to reject a single-product aftermarket. In particular, there is no economic requirement that consumers be duped in order to be locked into the Android operating system and then beholden to a provider in the Android App Distribution Market. Lock-in is not an information problem. Movie patrons who pay supra-competitive prices for popcorn, or hotel guests who pay supra-competitive prices for movie rentals are not duped; they simply do not wish to incur the costs of leaving the movie theater (or hotel) to find a cheaper substitute for the ancillary product. Much of Google's anticompetitive conduct is unknown to consumers: The OEM provisions are confidential, as are Google's anticompetitive payments to carriers and OEMs. *See also* Rachel Rickard Straus, *Apple faces landmark legal claim that could pay out to millions: Rip-off that adds 30% to price of smartphone Apps*, THIS IS MONEY (Dec. 11 2021), thisismoney.co.uk/money/bills/article-10299235/Rip-adds-30-price-smartphone-Apps html ("Most customers do not realise they are in effect paying huge commissions. But claimants say Apple and Android users have no alternative so Apple and Google can effectively charge what they like."). But even if consumers had been fully aware of the Challenged Conduct, the impact of such restraints are simply baked into the price of Apps and In-App Content, which consumers are obliged to pay given the lack of competitive alternatives. In any case, to the extent *Newcal* (improperly) requires information asymmetries between the wrongdoer and the ultimate consumer for the existence of an aftermarket, the evidence shows that the markets in this case are characterized by such asymmetries.

the Apple App Store. Although Google Android mobile devices may sometimes compete with Apple devices with respect to the initial choice of a device (and the associated OS ecosystem), the competition is limited by differences in pricing, features, and customer bases. Android and iOS compete for different users at different price points; Android smartphones are considerably less expensive than iPhones. In the United States Android smartphones are priced, on average, at less than half of the price of an iPhone.[87] Worldwide, the price discrepancy is even greater.[88] Not surprisingly, this means that Android and iOS compete for different bases of users. A 2021 Google analysis of recent U.S. smartphone purchasers found that iOS was the primary phone OS for [redacted] of consumers purchasing devices in the "Premium Ultra" tier (devices priced at or above $950); Android the OS of choice for [redacted] of those who bought devices in the "Low" device tier (devices priced at less than $200) and for [redacted] of buyers in the "Mid" tier (devices priced between $200 and $399).[89] One industry analysis found that iPhone users in the United States earn substantially more than Android users, and that iPhone users also spend about twice as much per month on technology, compared with Android users.[90] Android smartphones also encompass a greater range of devices, compared with iOS, which offers a more limited selection of higher-end devices.[91]

48. Once a user selects either a Google Android or iOS device, that user is largely locked in, because the costs of switching from one OS to another are substantial. Economists recognize that switching costs and customer lock-in confer "lucrative ex post market power."[92] Economists have documented substantial switching costs between mobile operating systems, including between Android and iOS. In a 2021 study published in the *Journal of Industrial*

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87. Amit Chowdhry, *Average iPhone Price Increases To $687 and Android Decreases To $254, Says Report*, FORBES (Feb. 3, 2015), forbes.com/sites/amitchowdhry/2015/02/03/average-iphone-price-increases-to-687-and-android-decreases-to-254-says-report/?sh=d9bcd17539e4.

88. *Id.*

89. GOOG-PLAY-011119640 at -643, -651. Only [redacted] of purchasers of devices in the "Mid" and "Low" tiers even considered purchasing an iOS device. *Id.* at -656. A corporate designee testifying on behalf of Google confirmed that, historically, "iPhones have been more expensive than Android phones, and so a significant portion of the Android audience -- user base has been on less expensive phones, and it's been cost-prohibitive for them to switch to an iPhone." Rasanen Dep. 20:5-21.

90. *See* Slickdeals, *iPhone Users Spend $101 Every Month on Tech Purchases, Nearly Double of Android Users, According to a Survey Conducted by Slickdeals*, CISION PR NEWSWIRE (Oct. 30, 2018), prnewswire.com/news-releases/iphone-users-spend-101-every-month-on-tech-purchases-nearly-double-of-android-users-according-to-a-survey-conducted-by-slickdeals-300739582.html?c=n ("iPhone users make an average salary of $53,251 and are more likely to splurge on commodity items than those with Androids. On the contrary, Android users make an average salary of $37,040, making it a plausible reason as to why they may be drawn to the cheaper prices of Android products.").

91. *See, e.g.,* Steven J. Vaughan-Nichols, *iPhone vs. Android: How to choose the best smartphone for you*, COMPUTERWORLD (Mar. 3, 2022), computerworld.com/article/2468474/iphone-vs-android-which-is-better-for-you.html ("With iPhones, the operating system and the hardware are tied at the hip. With Android phones, it's a different story. There is such an enormous difference between Android smartphones that comparing an iPhone 13 with, say, and excellent budget Android smartphone, such as 2020's Moto G Power, is like comparing apples (ahem) and oranges.").

92. *See, e.g.,* Joseph Farrell & Paul Klemperer, *Coordination and Lock-In: Competition with Switching Costs and Network Effects* 3 HANDBOOK OF INDUSTRIAL ORGANIZATION 1970-2056, 1970 (2007) ("Lock-in hinders customers from changing suppliers in response to (predictable or unpredictable) changes in efficiency, and gives vendors lucrative ex post market power – over the same buyer in the case of switching costs (or brand loyalty), or over others with network effects."). *See also* Paul Klemperer, *Markets with Consumer Switching Costs*, 102(2) Q. J. ECON. 375 (1987).

Economics, the authors "find that there are significant switching costs between [mobile] operating systems and brands[.]"[93] When translated into monetary terms, the cost of switching from Android to iOS is estimated at between €391 and €441.[94] Switching costs are likely even higher for many consumers, given that the authors' methodology obliges them to "use only observations for consumers who switch handsets and who therefore must have lower switching costs than others."[95]

49. Google's internal data shows that it is rare for users to switch from Android to iOS. One Google survey conducted between December 2019 and January 2020 found that only [redacted] of U.S. Android users purchasing a new device switched to iOS.[96] Given that most users do not purchase a new device every year, a smaller percentage of Android users switch from Android OS annually.[97] Independent analyses have found that Android users display a high degree of brand loyalty (measured as the percentage of customers that remain with their existing OS when activating a new phone) at around 89 to 91 percent in 2017.[98] One 2021 survey found that less than 20 percent of Android users were willing to even consider switching to an iPhone 13, let alone actually make the switch.[99] According to one Google document, of those that did purchase a new Android device in 2018, only 36 percent even considered purchasing an iOS device.[100] A June 2020 "Android Brand Health" presentation observed that "while owners may consider the other OS, **the intent to use another OS is incredibly low**, potentially driven by high switching costs and/or loyalty to their existing OS."[101] The presentation summarized the data as follows: "If you remember nothing else…owners prefer their devices to the alternative – and plan to stick with them."[102]

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93. Lukasz Grzybowski & Ambre Nicolle, *Estimating Consumer Inertia in Repeated Choices of Smartphones* 69(1) J. INDUS. ECON. 33, §5.2 (2021).

94. *Id.* at Figure A.2.

95. *Id.* §5.2.

96. GOOG-PLAY-000277908.R at -913.R-914.R. Another Google study in 2016 found that Android had 86 percent brand loyalty and a 21-month purchase cycle. *See* GOOG-PLAY-000572041.R at -2048.R. Google marketing analytics in 2018 and 2019 found that 90 percent of Android owners purchasing a new device within the previous twelve months purchased another Android device. *See* GOOG-PLAY-004556784.R at -793.R (Q3 2018 marketing analytics); GOOG-PLAY-005705974.R at -985.R (Q4 2019 marketing analytics). Another 2017 Google presentation cited Android's U.S. retention rate – the rate at which Android device owners purchasing a new device stay with Android – as 86%. *See* GOOG-PLAY-001558912.R at -919.R.

97. GOOG-PLAY-007745710 at -722 (May 2021 presentation explaining that only [redacted] of Android users switch to iOS in a given month).

98. Consumer Intelligence Research Partners, LLC, *Mobile Operating System Loyalty: High and Steady* (Mar. 8, 2018), files.constantcontact.com/150f9af2201/4bca9a19-a8b0-46bd-95bd-85740ff3fb5d.pdf ("Android has a 91% loyalty rate, compared to 86% for iOS, measured as the percentage of customers that remain with each operating system when activating a new phone over the twelve months ending December 2017."); Lucas Mearian, *iOS vs. Android: When it comes to brand loyalty, Android wins*, COMPUTERWORLD (Mar. 9, 2018), computerworld.com/article/3262051/ios-vs-android-when-it-comes-to-brand-loyalty-android-wins html.

99. *See, e.g.*, Abhin Mahipal, *Survey: 18% of Android users would consider switching to iPhone 13, but this is down 15% from last year*, SELLCELL (Aug. 31, 2021), sellcell.com/blog/survey-18-percent-of-android-users-would-consider-switching-to-iphone-13/. A 2020 survey found that 33 percent of existing Android users would consider switching to an iPhone 12. *See* Abhin Mahipal, *Survey: 3 in 10 Android Users Would Consider Upgrading to iPhone 12*, SELLCELL (Oct. 5, 2020), sellcell.com/blog/survey-3-in-10-android-users-would-consider-upgrading-to-iphone-12/ . It bears noting that being open to considering switching is not the same actually switching.

100 GOOG-PLAY-011269729 at -770.

101.GOOG-PLAY-011128192 at -197 (emphasis in original).

102.GOOG-PLAY-011128192 at -194.

50. Because apps are neither interoperable nor transferable, a user switching from a Google Android device to an iOS device cannot transfer all apps to a new phone. The user must re-download and install apps, and may need to find substitutes for apps not available on the new OS. Users may need to repurchase paid apps and any in-app content, and may end up losing their app-related data if unable to transfer it.[103] Transferable app data and customization settings must be transferred to the new device as well, a process that entails additional time and effort.[104] Users may also need to cancel subscriptions and re-subscribe when switching to a new OS.[105]

51. Users report losing the data on their devices and the difficulty of learning a new brand or OS as two top concerns related to switching.[106] Even if the user understands how to transfer data, the process is typically time-consuming and labor-intensive. Transferring from an iOS to an Android device, for example, "involves an average of 40 steps and can take as long as 9 hours" under some circumstances.[107] In studying this switching process, Google observed that it "really IS NOT as easy as 1, 2, 3."[108] After transferring their data, users must then undertake the process of learning the new OS. As one Google study explained, the cumulative effect of switching new app stores, music services, and other default apps "feels a lot like learning a foreign language."[109] The costs associated with learning a new OS contribute further to switching costs.[110]

52. Still other factors contribute to switching costs. Once a consumer has grown comfortable with one brand, switching may be perceived as a source of discomfort.[111] A 2017 presentation titled "Switching to Pixel" describes the "switching user journey."[112] User concerns are summarized under the heading "Fear of the Unknown," listing questions users may ask before switching from an iPhone to an Android device, such as "Will it do everything my current phone does?" "Will I know how to use it?" and "What will it say about me?"[113] Google recognizes that

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103. Nabila Amarsy, *Switching Costs: 6 Ways to Lock Customers Into Your Ecosystem*, STRATEGYZER (July 27, 2015), strategyzer.com/blog/posts/2015/7/27/switching-costs-6-strategies-to-lock-customers-in-your-ecosystem ("The 'Data trap'… encourages customers to create or purchase content or Apps that are exclusively hosted on a platform.").

104. *Id.* In addition, I understand that Professor Presser concludes based on his survey analysis that "A large majority believes such a switch would require more than a little effort or would lead to worry about losing access to photos, phonebooks, or other things now on the Android phone." Expert Report of Dr. Stanley Presser (Oct. 3, 2022) [hereafter, "Presser Report"] at 11.

105. Economists recognize that firms in ancillary markets or aftermarkets may wield power even when the forward market is competitively supplied. For a review of the literature, see Hal Singer & Andrew Card, *Lessons from Kahneman's Thinking Fast and Slow: Does Behavioral Economics Have a Role in Antitrust Analysis?*, ANTITRUST SOURCE (2012), www.semanticscholar.org/paper/Lessons-from-Kahneman-%E2%80%99-s-Thinking-%2C-Fast-and-Slow-Kahneman/8abf422dc2aca5adf6fe6c20e9064863f64819dd?p2df.

106. GOOG-PLAY-000880576.R at -580.R.

107. *Id.* at -589.R.

108. *Id.*

109. *Id.*

110. Switching costs appear to accumulate with time invested in the Android device, as proxied by the age of the owner. *See, e.g.*, GOOG-PLAY-002416488 ([redacted].

111. *See* Thomas A. Burnham, Judy K. Frels, and Vijay Mahajan, *Consumer Switching Costs: A Typology, Antecedents, and Consequences*, 31(2) J. ACAD. MKT. SCI. 109 (2003).

112. GOOG-PLAY-007317466 at -467. Pixel is a Google smartphone.

113. *Id.* at -473.

the Play Store "is creating brand loyalty and 'stickiness' to Android and the Google ecosystem thus becoming a critical channel to our end users."[114]

53. Users also benefit from the complementarity of multiple devices within the same ecosystem; switching ecosystems may jeopardize those benefits. As a 2020 presentation to Google's Board of Directors explained, "Users are also buying into an ecosystem – not just a mobile device."[115] A user might use her smartphone when traveling during the day and switch to using a tablet later at night. This user would likely gain value from the ability to sync files, settings, user information, and other features among these multiple devices.[116] Many apps do not allow for this synchronization across different operating systems. Accordingly, a user may not find it worthwhile to switch ecosystems unless they switch all of their devices. Many users are thus locked into an OS in part because they are locked into an OS ecosystem. Ecosystem lock-in can be seen in data related to users' likelihood of switching ecosystems; Google has determined that Android smartphone owners who switch to iOS are "half as likely to own an Android tablet compared to Android loyalists."[117]

54. This complementarity extends to groups of people. A household contemplating purchasing multiple devices would value the ability to integrate their apps and files—perhaps through parental controls on apps and screen time, location tracking abilities, and through family plans that allow the sharing of purchases and subscriptions.[118] To achieve this compatibility, the household would likely need to all use the same operating system, leading the household to become "locked in" to that ecosystem.[119]

55. Consumers are not typically informed at the point of purchase that approximately 30 percent of their expenditures on App or In-App Content is collected by Google, nor are they told of Google's restrictions on OEMs, carriers, and developers that result in foreclosure of competitive App stores. Instead, Google touts Android as an "open" system.[120] Without knowledge of the anticompetitive restrictions, consumers are unlikely to foresee that, by purchasing an

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114. GOOG-PLAY-004237669.R at -673.R.

115. GOOG-PLAY-001018676.R at -692.R.

116. Different operating systems offer different features for synchronizing devices. For instance, Microsoft Windows offers a "Your Phone" App which can tie together an android operated phone and computer. Similarly, Apple offers a "Continuity" feature which functions similarly for Apple products. *See* David Nield, *It's time to let your computer and phone hook up*, POPULAR SCIENCE (Feb. 16, 2022), popsci.com/phone-computer-work-together/.

117. GOOG-PLAY-000572041.R at -050.R.

118. For example, Apple's "Family Sharing" allows families to share services such as Apple Music, Apple TV+, App Store purchases, iCloud storage, and photo albums. It also allows parents to approve what their children purchase, limit their time on devices, and see their location. *See* Apple, *What is Family Sharing?,* support.apple.com/en-us/HT201060. *See also* Abdulf, *How to set up family sharing on iPhone and Android*, GIFFGAFF (July 26, 2019), giffgaff.com/blog/how-to-set-up-family-sharing-on-iphone-amp-android/ (describing the process of setting up the Google Play Family Library service).

119. Travers Korch*, How tech ecosystems lock you into costs*, BANKRATE (Sep. 30, 2014), web.archive.org/web/20210602055404/https:/www.bankrate.com/finance/smart-spending/tech-ecosystems-cost-you-1.aspx%20. Google has pursued a shared "Family Music Library," which would facilitate household lock-in. *See* GOOG-PLAY-000572041.R at -042.R

120. *See, e.g.,* Android Open Source Project, https://source.android.com/ ("Android unites the world. Use the open source Android operating system to power your device.").

Android device, they will effectively be locked into a product that extracts supracompetitive profits every time they make a purchase.

c. Developers Have Economic Incentives to Develop Apps For Both Android and iOS, Further Insulating iOS and Google Android From Head-to-Head Competition

56. In the abstract, one could hypothesize that a developer could respond to an exercise of market power by Google Android by switching to iOS. But from a developer's perspective, iOS and Android do not compete as "either-or" substitutes. A successful developer does not have to choose between offering its app only on iOS or only on Android, just as a successful online retailer does not have to choose between selling its products only on the east coast or only on the west coast. In each case, the firm is likely better off doing both. A developer that restricted itself only to iOS would deprive itself of the revenue to be gained from accessing Android's massive installed customer base. Record evidence indicates that app developers generally do not consider Android and iOS as substitutes, and instead seek to maximize their reach across different platforms. For example, 99 of the top 100 apps by spend in the Play Store are also available on the Apple App Store.[121]

57. Adrian Ong, a Match.com executive, testified that Android is not a substitute for iOS for Match's products.[122] Andrew Grant of Epic testified that many games are released on multiple platforms, ranging from "big-budget games" to "smaller Indie games."[123]

2. Niche Mobile OSs Do Not Constrain Google Android's Market Power

58. Although there are non-Android and non-iOS mobile operating systems, they constitute an economically insignificant share of the market.[124] and there is no comparable ecosystem of apps to run on these devices. In assessing one such OS, one industry source reported that "[a]s with most alternate OSes, finding popular apps, or at the very least approximations, is a challenge."[125] An OEM attempting to develop its own non-Android OS would face these same barriers from a limited App ecosystem, and would also face the cost of developing and launching a device on a new OS.

59. The immense costs and complexities of developing a new mobile OS create barriers to entry, such that a SSNIP by a hypothetical monopolist of licensed operating systems would not plausibly induce an OEM to create its own system or a rival mobile OS developer to enter. These entry barriers have proven formidable, even to well-established and technologically sophisticated firms such as Facebook and Amazon. As the House Investigation of Competition in Digital Markets has observed, "several large technology companies have attempted and failed to leverage

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121. *See* Appendix 9.

122. Deposition of Adrian Ong [hereafter Ong Dep.], *Epic v. Apple* (20-cv-05640-YGR) at 67:23-68:02 ("Q. Have you reached any conclusions about whether Android is a substitute for iOS for Match Group's products? A. It is not a substitute.").

123. Deposition of Andrew Grant [hereafter Grant Dep.] at 26:12-27:3..

124. *See* Figure 4, *supra*.

125. Max Eddy & Ben Moore, *Break Away From Android and iOS: 7 Free Open-Source Mobile OSes to Try*, PCMAG (Jan. 28, 2021), pcmag.com/picks/break-away-from-android-ios-7-free-open-source-mobile-oses-to-try.

their large user bases to compete against Apple and Google in the mobile OS market."[126] Even firms with desktop operating systems such as Microsoft have failed to make significant inroads into mobile device operating systems. In January 2019, Microsoft announced that it would end support for its Windows 10 mobile operating system.[127] Windows was estimated to have spent more than $1 billion in developing and launching the Windows Phone 7.[128] Microsoft's failure is consistent with significant barriers to entry in mobile operating systems markets. Accordingly, an exercise of market power by Google in the market for licensable operating systems also would not plausibly induce an OEM to create its own system or a rival mobile OS developer to enter.

3. "Forked" Android Does Not Constrain Google Android's Market Power

60. An OEM currently licensing Google Android OS is barred from selling "forked" Android devices by Google's Android Compatibility Commitment ("ACC"), previously known as the Anti-Fragmentation Agreement ("AFA").[129] OEMs are therefore practically prohibited from responding to an exercise in Google Android's market power by developing a new Android-based OS or by licensing another Android-based OS, such as Amazon's Fire OS. Record evidence indicates that the AFAs have frustrated Amazon's attempt to deploy a competing mobile OS. [redacted]

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126. *Majority Staff Report* at 105-107 ("Over the past decade, several large technology companies have attempted and failed to leverage their large user bases to compete against Apple and Google in the mobile OS market. Facebook and Amazon both tried to enter the market with variants of Google's Android OS. Both companies quickly exited the market because consumers were mostly accessing Facebook and Amazon content through Apps on iOS and Android devices…Companies like Mozilla and Alibaba have also attempted to enter the mobile OS market. Mozilla unveiled its Firefox OS in 2013 and exited the market altogether by 2016. In 2012, Chinese tech giant Alibaba developed a mobile OS called Aliyun for the Chinese market. However, Acer, Alibaba's hardware partner, abruptly canceled its collaboration with Alibaba before the launch of Acer's device running the OS. Over the past decade, once-competitive mobile operating systems like Nokia, BlackBerry, and Microsoft struggled to survive as Apple and Google grew more dominant, eventually exiting the marketplace altogether. BlackBerry—once a leading mobile OS developer—now licenses the BlackBerry name to TCL to market TCL's smartphones. TCL's BlackBerry phones run on Android. In the last quarter of 2016, Windows devices accounted for less than half of 1% of new smartphone sales. In 2017 Microsoft abandoned its mobile OS business, and by that time, more than 99% of all new smartphones were running on iOS or Android and market observers expressed no confidence that new competition would emerge. One key factor leading to Microsoft's withdrawal from the mobile marketplace was that developers were reluctant to develop Apps for a third mobile operating system when already building Apps for iOS and Android. These market dynamics remain in place today."). This is consistent with the evidence I have examined in this case.

127. *See* Rob Enderle, *How Microsoft failed with Windows 10 Mobile*, COMPUTERWORLD (Jan. 24, 2019), computerworld.com/article/3336057/how-microsoft-failed-with-windows-10-mobile html.

128. Kim-Mai Cutler, *Microsoft to Pay More Than Half a Billion Dollars to Jump-Start Windows Phone 7*, TECHCRUNCH (Aug. 26, 2010), techcrunch.com/2010/08/26/microsoft-half-billion-dollars-windows-phone-7/.

129. GOOG-PLAY-000416448 at -449 (ACC executed 8/28/201: "All devices based on Android that Company manufactures, distributes, or markets will be Android Compatible Devices," and defining "Android Compatible Devices" as "devices that comply with the Android Compatibility Definition Document ('CDD'), which can be found at http://source.android.com/compatibility (or successor sites) and which may be updated from time to time by Google with Company's assistance."); GOOG-PLAY-000458664.R (2017 Google presentation slide titled: "Starting in April, we will be rolling out a new AFA – known as the Android Compatibility Commitment (ACC)."); GOOG-PLAY-000422837 at -838 (February 2017 email from Google's Hiroshi Lockheimer to a Samsung executive explaining that Google "will no longer be calling it the AFA but rather the ACC -- the 'Android Compatibility Commitment.'"); *see also* GOOG-PLAY-000127155 (Standard AFA Agreement signed by Huawei Device (Dongguan) Co. Ltd. Effective April 6, 2015); GOOG-PLAY-000808433 (LG AFA effective 1/25/2011); GOOG-PLAY-000808062 (Motorola AFA effective 10/2/2015); GOOG-PLAY-000808451 (HTC AFA effective 6/14/2012); GOOG-PLAY-003604523 (Samsung AFA effective 5/9/2012). *See also* Part IV.A.2 below (reviewing AFAs).).

[redacted]

61. Even setting aside the AFAs, developing an Android fork would likely constitute a cost-prohibitive barrier to entry. According to Amazon, it invested "hundreds of millions of dollars in the development of Fire OS."[133]

4. Devices Such as PCs, Gaming Consoles, and Feature Phones Do Not Expand the Relevant Market

62. Devices such as PCs and gaming consoles also require operating systems in order to function. As explained below, these devices do not expand the relevant market for licensed mobile operating systems.[134] From a consumer's perspective, the functionality of a PC or gaming console is distinct from that of a smartphone, which explains why households commonly own two or three of these types of devices, using each technology for distinct purposes. Further, in the case of a consumer who owns an Android phone but not a console or PC, any substitution towards consoles or PCs would require the purchase of new hardware, further reducing the viability of significant defection. From a developer's perspective, the mobile, Android App ecosystem represents too large a customer segment to ignore.[135] Indeed, the sales of mobile games are roughly equal to the *sum* of sales of console and PC games.[136] Not only would developers sacrifice significant sales by walking away from the Play Store, but, for those who had not yet done so, they would also incur additional expense to write code for an Android-based App to work in a console or PC environment.

63. Smartphones are highly mobile, and are now a ubiquitous accessory of modern life. In contrast, the experience on devices such PCs and gaming consoles typically involves tradeoffs of portability in favor of larger screen sizes, greater computing power, little to no concern over

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130. AMZ-GP_00001837 at -838.
131. AMZ-GP_00001840 at -855.
132. AMZ-GP_00001837 at -838.
133. AMZ-GP_00001904 at -908.
134. Deposition testimony indicates that Google's executives view Googles' distinct operating systems for PC ("ChromeOS") and mobile (Android) as "different products" serving "different customer bases" and requiring "different partners." Lockheimer Tr. at 30:6-32:18.
135. The value of transactions in the Play Store reached $47.9 billion in 2021. *See* Mansoor Iqbal, *App Revenue Data (2022)*, BUSINESS OF APPS (Sep. 22, 2022), businessofApps.com/data/app-revenues/ (citing App Annie and Sensor Tower).
136. WEPC, *Console Gaming Statistics 2022,* (Jan. 20, 2022), wepc.com/statistics/console-gaming/.

battery life, and little or no mobile broadband access.[137] It is therefore unsurprising that, although the vast majority of U.S. households own some combination of desktops, laptops, tablets, smartphones, and other computing devices,[138] only a small percentage are "smartphone-only."[139]

64. A 2019 industry report found that "Global audiences are spending more time on mobile."[140] The report found that mobile devices account for a high percentage of the time that consumers spend online in countries ranging from Canada (72 percent) to Indonesia (91 percent).[141] The report also found that the "Share of mobile time spent is reaching historic levels in the U.S. in key categories," finding that mobile usage accounts for 94 percent of gaming time, 92 percent of social media time, 83 percent of entertainment time.[142]

65. For some gaming applications, users can sometimes play on multiple platforms ("cross-platform" gaming), which has various components. One component is "cross-platform distribution," which refers to the availability of a given game on multiple platforms.[143] Another is the ability to play multi-player games with competitors on different platforms, referred to as "cross-play";[144] another is the ability to save gaming progress and to carry the progress across platforms, referred to as "cross-progression."[145]

66. Cross-platform gaming has not been and is not presently a significant factor in Google's pricing to developers on its Play Store. Cross-platform distribution, cross-play, and cross-progression are relatively new and emerging features in mobile games, and have not been a

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137. *See, e.g.,* Computer Hope, *Computer vs. smartphone* (November 6, 2021), computerhope.com/issues/ch001398 htm.

138. U.S. Census Bureau, *Computer and Internet Use in the United States: 2018* (April 2021), census.gov/content/dam/Census/library/publications/2021/acs/acs-49.pdf at 2 ("[I]n 2018, 92 percent had at least one type of computer," defining "computer" to include "all desktops, laptops, tablets, and smartphones as computers, along with selected computing technologies such as smart home devices and single board computers such as RaspberryPi and Arduino boards compiled from write-in responses.").

139. *Id.* (Figure 4 shows only about 8.8 percent of U.S. households had only a smartphone, referencing U.S. Census Bureau, 2018 American Community Survey, 1-Year Estimates). *See also* U.S. Census Bureau, *2018: ACS 1-Year Estimates Subject Tables - S2801 Types of Computers and Internet Subscriptions*, https://data.census.gov/cedsci/table?q=smartphone&tid=ACSST1Y2018.S2801 (showing 10,692,656 households with a smartphone and no other type of computing device, out of 121,520,180 households total; the share of smartphone-only households is therefore 8.8 percent (equal to 10,692,656/121,520,180)). *See also* U.S. Census Bureau, *Computer and Internet Use in the United States: 2016* (August 2018), census.gov/content/dam/Census/library/publications/2018/acs/ACS-39.pdf at 2 ("A small percentage of households have smartphones but no other type of computer for connecting to the Internet.").

140. Comscore, *Global State of Mobile* (2019), comscore.com/Insights/Presentations-and-Whitepapers/2019/Global-State-of-Mobile at 11 (showing the percentage of minutes spent on mobile devices versus desktop computers).

141. *Id.*

142. *Id.*

143. Jesse Lennox and Jacob Roach, *All cross-platform games (PS5, Xbox Series X, PS4, Xbox One, Switch, PC)*, DIGITAL TRENDS (June 30, 2022), digitaltrends.com/gaming/all-cross-platform-games/.

144. Epic's Vice President of Business Development Joe Kreiner explained: "Cross-play is defined as the ability of a game to have players matchmake across different platforms and play together." Kreiner Dep. 44:5-8.

145. Weissinger Dep. 57:20-59:3 ("Cross-progression would mean when I'm playing in the game and I'm progressing on one platform that the experience which is kind of one of the ways you progress inside of Fortnite transfers to other platforms. . . . There is a number of games that do not do that. And if you were to play them on different platform [sic] you would not progress . . . .").

significant factor for most of the Play Store's history.[146] Google recognizes that [redacted] Google's business strategy documents [redacted] recognizing that mobile games and console games are separate markets.[148] In 2020, Google characterized multi-platform gaming as a developing trend, as opposed to an established one: [redacted]

67. Monster Strike, at one time the highest grossing mobile game of all time, has been released only on mobile devices.[150] Google recognizes that some of the most popular mobile games, such as casual games,[151]may not be well-suited to PC or console play. Sony did not permit cross-platform play involving PlayStation consoles until September 2018.[152] As of January 2022, there were approximately 930 games on the Epic Games Store, but only one of those games (Fortnite) offered cross-play with mobile devices.[153] PUBG Mobile, the highest grossing game in 2020 and 2021,[154] does not offer cross-platform play between its mobile App and PUBG players on consoles.[155]

68. Even for games better-suited to cross-platform distribution, the developer must invest substantial resources to "port" a game developed for one platform to another. Epic spent eight to nine months porting Fortnite's console game into a mobile version for release on Android.[156] And even for games that do enable cross-play, multiple factors may limit players' willingness to substitute gameplay on a mobile device for gameplay on a different platform. *First*, many games with cross-platform capabilities lack cross-progression – the ability for a user to save

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146. The opinion in *Epic v. Apple* allowed for the possibility that certain games exhibit cross-platform substitutability but concluded that these games were outliers: "However, not all games are like Minecraft or Fortnite; the market still reflects that video games are, for the most part, cabined to certain platforms that take advantage of certain features of that platform, such as graphics and processing, or mobility." Rule 52 Order After Trial On The Merits, *Epic v. Apple*, Case No. 4:20-cv-05640-YGR, at 84. Because the instant matter concerns all Apps, including non-gaming Apps, the conclusion that console and PC gaming are distant substitutes for Play Store users would be bolstered.

147. GOOG-PLAY-000231487 at -489 ("We expect cloud gaming to arrive at scale in the late 2020s.").

148. GOOG-PLAY4-002366557 at -562 ("Video Games" definition "[e]xcludes all revenue related to mobile games (on smartphones, tablets), which is included under mobile apps.")

149. GOOG-PLAY-006850420.

150. Adam Spannbauer, *Monster Strike Revenue Passes $7.2 Billion, Making It the Highest Earning App of All Time*, SENSOR TOWER (Oct. 2018), sensortower.com/blog/monster-strike-revenue.

151. GOOG-PLAY-006850420 at -420 ("Some games will work better as cross platform games (e.g. Battle Royale vs. a Casual game like Gardenscapes.").

152. Keza MacDonald, *PlayStation 4 opens up cross-platform play, starting with Fortnite,* THE GUARDIAN (Sept. 26, 2018), theguardian.com/games/2018/sep/26/playstation-4-opens-up-cross-platform-play-starting-with-fortnite.

153. Steven Allison Dep. 348:18-25 ("Q. How many games on the Epic Games Store currently offer cross-play with mobile games? A. One. Fortnite. Q. And how many games in total are there in the Epic Games catalog, approximately? A. Around 930.").

154. David Curry, *PUBG Mobile Revenue and Usage Statistics (2022)*, BUSINESS OF APPS (Sep. 6, 2022), businessofapps.com/data/pubg-mobile-statistics/.

155. Stefan Miguel Lopez, *Is PUBG Cross Platform?*, GAME RANT (July 13, 2021), gamerant.com/pubg-cross-platform-cross-play/.

156. Nicholas Penwarden Dep. 313:21-314:6 ("Q. So how long did it take Epic to port Fortnite from consoles to Android? A. My recollection is we made a proof of concept for Fortnite mobile in November 2017 and started working in earnest that December and ultimately shipped in August of 2018. So it ended up taking us about eight to nine months.").

his or her progress in the game on one platform and continue from that same point on another platform.[157] *Second*, mobile gamers may also be reluctant to engage in cross-play because of inherent disadvantages for players using a mobile device. According to Epic, even when cross-play is available between mobile devices and consoles, "it's more difficult for people to play with a touch screen than it is with a game controller."[158] Because console gamers "have a controller, they are more likely to win a match over someone on . . . a phone device."[159] Google employees have also noted that Epic takes steps to ensure mobile gamers are segregated from non-mobile gamers in cross-play games.[160] *Third*, limitations on "cross-wallet" capabilities limit users' ability to easily switch between mobile devices and other gameplay platforms. PlayStation announced only relatively recently (in May 2022), that it would, for the first time, allow users to use Fortnite "V-bucks" regardless of what platform they were purchased on.[161] Nintendo still blocks cross-wallet capabilities.[162] The inability to spend purchased in-App currencies across platforms further limits the appeal of transitioning between mobile games and other platforms.

69. To the extent that some users access games on both their mobile devices and their PCs, this does not imply that gaming on a PC is an economic substitute for gaming on a mobile device. If anything, they are more likely to be economic complements. For example, although some consumers have both landlines and mobile phones, this does not imply that the consumer would be willing to drop their mobile service entirely and to rely exclusively on their landline in order to avoid a price increase in their mobile service.

70. So-called "feature phones"—older devices that lack touchscreens and other key features—do not expand any of the relevant antitrust markets here. Devices such as 1990s-era "flip phones" are useful primarily for sending and receiving voice calls and text messages, along with limited Internet access.[163] Feature phones have an extremely low market share in the U.S.

157. Weissinger Dep. 58 ("Cross-progression would mean when I'm playing in the game and I'm progressing on one platform that the experience which is kind of one of the ways you progress inside of Fortnite transfers to other platforms. . . . There is a number of games that do not do that. And if you were to play them on different platform [sic] you would not progress . . . .").

158. Kreiner Dep. 46:13-47:11.

159. *Id.* at 48:3-14.

160. GOOG-PLAY-006850420 ("Fortnite can be played across Xbox, Nintendo Switch, Playstation, iOS, Android and PC. However Fortnite ensures that mobile games are not competing with PC gamers who can easily win by having the advantage of mouse/keypad. It will pair up mobile gamers with other mobile gamers.").

161. Jason Guisao, *Fortnite V-Bucks Purchased On PlayStation Can Be Used Across All Platforms*, GAME INFORMER (May 17, 2022), gameinformer.com/2022/05/17/fortnite-v-bucks-purchased-on-playstation-can-be-used-across-all-platforms.

162. Weissinger Dep. 63:10-13 ("Q. But V-Bucks purchased on Nintendo Switch are not cross-wallet; is that a correct statement? A. Yes, I believe so."). *See also* Epic Games, *V-Bucks Purchased on PlayStation Join Fortnite Shared Wallet* (May 16, 2022), epicgames.com/fortnite/en-US/news/v-bucks-purchased-on-playstation-join-fortnite-shared-wallet ("Fortnite Shared Wallet is not currently supported by the Nintendo Switch platform, meaning V-Bucks purchased on other Shared Wallet platforms will not be usable on your Nintendo Switch and vice versa.").

163. *See, e.g.,* Adam Fendelman, *Cellphones vs. Smartphones*, LIFEWIRE (Oct. 19, 2021), lifewire.com/cell-phones-vs-smartphones-577507 ("Cellphones place and receive voice calls and send text messages. Smartphones do those things and more."). *See also* Difference Between, *Difference between Smartphone and Feature Phone* differencebetween.info/difference-between-smartphone-and-feature-phone ("Feature phone is a category of mobile phones that have minimal features and are moderately priced.").

(approximately two percent),[164] and consistently declining sales worldwide.[165] They are economically irrelevant here given that they cannot be used to distribute Apps or to purchase In-App Content.

71. As explained in Part II.A.3 below, the ability to access certain mobile games through web-based apps or game-streaming platforms does not expand the relevant market. These technologies have become available only recently, still have limited adoption, and still suffer from various technical limitations such as latency.

B. The Relevant Geographic Market Is Global (Excluding China)

72. According to standard antitrust principles, the relevant geographic market is "a region such that a hypothetical monopolist that was the only present or future producer of the relevant product at locations in that region" could profitably exercise market power.[166] None of the relevant geographic markets in the instant case include China, given that Google Play is blocked by the Chinese government.[167] A (not so) hypothetical monopolist over licensable mobile operating systems worldwide (excluding China) could profitability exercise market power over OEMs. For the reasons given in Part I.A above, OEMs could not defeat an exercise of market power by switching to iOS (which is not even licensable), or by switching to niche OSs, forked Android, or the various other alternatives reviewed in Part I.A. OEMs also could not defeat an exercise of market power by limiting their operations to China, given that there is there is (more than) sufficient demand in the global market outside of China to profitability sustain a hypothetical monopolist.

73. It is possible that a hypothetical monopolist over licensable mobile operating systems in the United States alone could profitably exercise market power over OEMs. Doing so is generally not necessary for purposes of my analysis here, given the global reach of Google's monopoly and its conduct.

C. Google Has Monopoly Power in the Distinct Market for Licensed Operating Systems

74. Market power can be shown using indirect evidence or direct evidence. Direct proof of market power relies on firm-specific information that speaks directly to a firm's ability to profitably raise prices or exclude rivals.[168] When, as is the case here, there is direct evidence that a firm has exercised market power, economists recognize that it is not economically necessary to

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164. *See, e.g.*, Emily Herbert, *Feature phones still have a place in the US market*, COUNTERPOINT (Jul. 6, 2022), counterpointresearch.com/feature-phones-still-place-us-market/.

165. *See, e.g.,* Statista, *Feature Phones – Worldwide*, statista.com/outlook/cmo/consumer-electronics/telephony/feature-phones/worldwide#revenue.

166. Department of Justice & Federal Trade Commission, *Horizontal Merger Guidelines* (2010), §1.2.

167. *See, e.g.,* Sherisse Pham, *Google now has two apps in China, but search remains off limits*, CNN BUSINESS, (May 31, 2018), money.cnn.com/2018/05/31/technology/google-in-china-files-app/index.html ("The company's own app store, Google Play, remains blocked in China[.]").

168. Herbert Hovenkamp, *Digital Cluster Markets*, 1 COLUMBIA BUSINESS LAW REVIEW 246, 272 (2022) ("By contrast, 'direct' proof relies on estimates of firm elasticity of demand, evidenced mainly by a firm's price-cost margins or output responses to price changes.[] These methodologies are capable of giving more accurate measures of market power as it is best defined, which is the ability of a firm to profit by raising its price above its costs[.]") citing 2B Phillip E. Areeda & Hebert Hovenkamp, ANTITRUST LAW ¶521 (5th ed. 2021) (forthcoming); Louis Kaplow, *Why (Ever) Define Markets?,* 124 HARVARD LAW REVIEW 437 (2010).

demonstrate market power indirectly.[169] This is particularly true in digital markets: As Herbert Hovenkamp, the co-author of a leading antitrust treatise, recently observed, "[D]igital markets are particularly susceptible to direct measurements of market power that do not depend on a market definition."[170] Nevertheless, for completeness I provide direct evidence of the Play Store's monopoly power and indirect evidence of market power in each of the relevant antitrust markets at issue here.

75. High market shares within a relevant antitrust market combined with evidence of entry barriers provide indirect evidence of a firm's market power.[171] The standard method for defining relevant antitrust products markets is the hypothetical monopolist test ("HMT").[172] The HMT requires that a relevant antitrust product market contain enough substitute products such that a hypothetical profit-maximizing firm that was the only present and future seller of those products would likely impose at least a small but significant and non-transitory increase in price ("SSNIP") above competitive levels.[173] If a candidate market contains too few substitute products for a hypothetical monopolist to profitably exercise a SSNIP, the relevant market is expanded by adding more substitute products until a SSNIP becomes profitable.[174] The exercise in market power

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169. *See, e.g.,* Jonathan Baker & Timothy Bresnahan, *Economic Evidence in Antitrust: Defining Markets and Measuring Market Power in* PAOLO BUCCIROSSI, ED., HANDBOOK OF ANTITRUST ECONOMICS 1- 42 (MIT Press 2008) [hereafter Baker & Bresnahan], at 15. *See also* Aaron S. Edlin & Daniel L. Rubinfeld, *Exclusive or Efficient Pricing? The Big Deal Bundling of Academic Journals*, 72 ANTITRUST L.J. 119, 126 (2004) ("Market definition is only a traditional means to the end of determining whether power over price exists. Power over price is what matters…if power can be shown directly, there is no need for market definition: the value of market definition is in cases where power cannot be shown directly and must be inferred from sufficiently high market share in a relevant market."). *See also* PHILLIP E. AREEDA, EINER ELHAUGE & HERBERT HOVENKAMP, 10 ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION 267, 325–28, ¶ 1758b. (1996 & Supp. 2003); *see also* PHILLIP AREEDA, LOUIS KAPLOW & AARON EDLIN, ANTITRUST ANALYSIS: PROBLEMS, TEXT AND CASES ¶ 344 (6th ed. 2004). *See also* Merger Guidelines, §4 ("[e]vidence of competitive effects can inform market definition[.]").

170. Herbert Hovenkamp, *Digital Cluster Markets*, 1 COLUMBIA BUSINESS LAW REVIEW 246 (2022).

171. *See, e.g.*, William Landes & Richard Posner, *Market Power in Antitrust Cases*, 94(5) HARVARD LAW REVIEW 937, 938 (1981) [hereafter Landes & Posner] ("The standard method of proving market power in antitrust cases involves first defining a relevant market in which to compute the defendant's market share, next computing that share, and then deciding whether it is large enough to support an inference of the required degree of market power."). *See also* Thomas Krattenmaker, Robert Lande, & Steven Salop, *Monopoly Power and Market Power In Antitrust Law* 76 GEORGETOWN LAW JOURNAL 241 (1987).

172. Department of Justice & Federal Trade Commission, *Horizontal Merger Guidelines* (2010), §4 [hereafter, *Merger Guidelines*].

173. *Id.*

174. *Id. See also* Department of Justice & Federal Trade Commission, Horizontal Merger Guidelines, *reprinted in* 4 Trade. Reg. Rep. ¶ 13,104, at § 1.11 (1992) ("If, in response to the price increase, the reduction in sales of the product would be large enough that a hypothetical monopolist would not find it profitable to impose such an increase in price, then the Agency will add to the product group the product that is the next-best substitute for the merging firm's product . . . . The price increase question is then asked for a hypothetical monopolist controlling the expanded product group. This process will continue until a group of products is identified such that a hypothetical monopolist over that group of products would profitably impose at least a "small but significant and nontransitory" increase ["SSNIP"], including the price of a product of one of the merging firms.") *See also* Michael L. Katz and Carl Shapiro, *Critical Loss: Let's Tell the Whole Story*, ANTITRUST 49 (2003) ("The now-standard procedure for defining relevant product markets in horizontal merger cases asks whether a hypothetical monopolist controlling a group of products would find it profitable to raise the price of at least one product significantly above the prevailing level.").

contemplated in standard antitrust market definition can come in the form of a price increase or in the form of "a corresponding non-price change such as a reduction in product quality or service."[175]

76. As detailed below, Google's monopoly power in the relevant antitrust market for licensed operating systems is established through direct evidence of its ability to exclude rival mobile OSs, as well as indirect evidence of high market shares, barriers to entry, and high profit margins.

1. Direct Evidence: Ability Exclude Rivals and Raise Prices

77. Google gained power in the licensed mobile device operating system market through its acquisition of Android and partnerships with OEMs and carriers. OEMs could not license Apple's iOS to manufacture mobile devices, but Google's Android OS and its proprietary suite of mobile Apps and interfaces, Google Mobile Services, was available under license. While Android is available pursuant to an open-source Apache license, Google used the revenue-sharing agreements to attract OEMs and carriers to select Google Android. In its revenue-sharing agreements, Google offered OEMs and mobile carriers significant percentages of the revenues generated by Google's search advertising and the Play Store.[176] The ability to exclude rivals—here, rival licensable operating systems that lacked a dominant search advertising business with which to fund OEMs and mobile carriers—is a hallmark of market power.[177]

78. As explained in Part IV.A.1 below, over time Google has systematically and substantially reduced the share of Google Play revenue paid to carriers and some OEMs, from 25 percent or more to just five percent. Google has also substantially reduced the share of mobile search revenue paid to OEMs.[178] Reducing the share of revenue paid to OEMs is economically analogous to a substantial and sustained increase in the price of Google Android, and constitutes direct evidence of market power in the licensed mobile device operating system market.

2. Indirect Evidence

a. High Market Share and Entry Barriers

79. Google accounts for nearly 100 percent of the market for licensed operating systems, providing persuasive indirect evidence of market power. When the market is properly limited to licensable mobile OSs, the data show plainly that smartphones with Google Android account for the vast majority of all smartphones sold with licensed operating systems, both in the U.S. and worldwide, as shown in Figure 4 above. Even if the market were (improperly) expanded

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175. *Merger Guidelines* §4.

176. *See, e.g.*, GOOG-PLAY-001184813 at -820 (showing that for 2014, Google earned $5,976M in search revenue on Android, with $467M paid to carriers and $217M paid to OEMs). By this point in time, carrier revenue shares were already reduced, suggesting the figures would be even higher in the Play Store's early days.

177. *See, e.g.*, Richard G. Price, *Market Power and Monopoly Power in Antitrust Analysis*, 75(1) CORNELL LAW REVIEW 190, 198 (1989).

178. For example, a 2010 contract with Google specifies that [redacted] of [redacted] When the contract was renewed in 2012, [redacted] share of [redacted] was reduced to just [redacted] *See* GOOG-PLAY-001559464.R at -492.R; GOOG-PLAY4-003083697 at -698 (slide deck titled "[redacted] Search Revenue Share Renewal").

to include iOS, there is a virtual duopoly between iOS and Android, as shown in Figures 3A-3B above.

80. Google's high share of the licensed mobile device operating systems market is protected by barriers to entry. Entry barriers in the market for mobile operating systems are steep.[179] Launching a competing mobile operating system requires developing the source code, contracting with OEMs, and convincing a critical mass of developers to write apps that are compatible with the new operating system, among other hurdles.[180] As explained in Part I.A.2 above, entry barriers have proven insurmountable even to well-established and well-capitalized technology firms such as Facebook, Amazon, and Microsoft.

81. The House Investigation of Competition in Digital Markets found evidence of significant entry barriers in the mobile operating system market, including the costs and complexities of offering "a superior product packaged in an attractive handset, as well as a fully realized suite of Apps and compatible devices comparable to what Apple and Google (and Google's hardware partners) currently offer."[181] Evidence from industry experts and investment analysts provides further confirmation of the barriers to successfully launching a competing mobile OS—even a product that "offered better features,"[182]—and noting the likelihood that Android and iOS "will continue to power nearly every smartphone around the world in the long run."[183]

82. Network effects are an economically significant entry barrier, working to the benefit of established incumbents (iOS and Google Android) while making it even more difficult for a new mobile OS to gain traction.[184] Google cemented its early market power in licensed mobile device operating systems by exploiting a natural feedback loop in which device makers adopted Android with Google Mobile Services, including Google's proprietary App distribution channel, which in turn attracted App developers, which in turn attracted consumers who sought Android

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179. *See, e.g.*, Alan Santillan, *Mobile Software: Why It's Only Android vs. iOS in 2020*, LEARN HUB (July 30, 2018), learn.g2.com/android-vs-ios ("Barriers to entry in the mobile space are extremely high, and the switching costs that Android and iOS deploy toward their users make it even harder for buyers to switch platforms."); European Commission, *Antitrust: Commission sends Statement of Objections to Google on Android operating system and applications – Factsheet* (Apr. 20, 2016), ec.europa.eu/commission/presscorner/detail/en/MEMO_16_1484 ("There are a number of barriers to entry that protect Google's position, including so-called network effects (that is, the more consumers adopt an operating system, the more developers write Apps for that system).").

180. *See, e.g.* Michael Katz & William Rogerson, *The Applications Barrier to Entry and Its Implication for the Microsoft Remedies: Comment on Iansiti and Richards*, 75(3) ANTITRUST LAW REVIEW 723 (2009) (explaining that a new OS will be desirable to consumers only if a broad array of software applications can run on it, but software developers will find it profitable to create applications that run on an operating system only if there is a large existing base of users).

181. *Majority Staff Report* at 104.

182. *Id.* (citing Richard Trenholm, *Elegant Ubuntu Touch OS Impresses for Phones and Tablets (Hands-On)*, CNET (Feb. 28, 2013), cnet.com/reviews/ubuntu-touch-preview/; Adrian Covert, *The Ubuntu Smartphone (Which No One Will Use) Is a Glimpse of the Future*, CNN BUS (January 2, 2013), money.cnn.com/2013/01/02/technology/mobile/ubuntu-smartphone-linux/ ("Carving out a niche in the seemingly unshakable mobile space -- ruled by the Android-and-Apple duopoly -- still requires a critical mass of users and a lively ecosystem of App developers.")).

183. *Id.* (citing MORNINGSTAR EQUITY ANALYST REPORT, APPLE INC 3 (Aug. 6, 2020)).

184. *Id.* ("The mobile OS market is also characterized by strong network effects. In short, a new mobile OS must have a sufficiently large user base to attract App developers to build Apps to run on the OS. An OS with an insufficient number of users and developers is unlikely to receive support from mobile device manufacturers that will install the OS on their devices, or mobile network operators that will support those devices on their networks.").

phones.[185] Google Android's monopoly in the licensed mobile device operating systems market benefits from "indirect network effects"—in this case meaning that the more developers who write apps compatible with an operating system, the more OEMs and consumers demand the operating system. This cycle of indirect network effects constitutes another barrier to potential suppliers of competing licensed mobile device operating systems.[186]

b. High Profit Margins

83. The ability to sustain high profit margins over extended time periods implies an ability to raise prices over competitive levels.[187] Record evidence indicates that Android generates substantial profits for Google. As early as 2010, a Google presentation noted that "Android created a hardware and services ecosystem worth over $43B a year[.]"[188] Android's contribution to Google's profit margins is estimated in Google's internal lifetime value ("LTV") analyses.[189] The purpose of Google's LTV analyses is to estimate "[w]hen an Android device is sold to a user, is there an incremental value to Google of future services margin channeled through this device, and if so, how much?"[190] In other words, the LTV analysis provides an estimate of the incremental profit that Google earns when a user switches from (say) an iPhone to an Android smartphone.

84. In the example below, Google performed a calculation in which the "Total Margin / Device" increased from [redacted] Part of this increase is driven by an increase in the "[redacted] Margin / Device", which increases from [redacted] The remainder is driven by an increase in the "[redacted] Margin / Device", which increases [redacted] The incremental margin associated with those switching from a "Feature" phone is even greater, at [redacted] This LTV analysis, evidently from 2018,[193] references similar results from a 2017 LTV model.[194]

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185. *See, e.g.,* GOOG-PLAY4-000336290.

186. *See, e.g.,* GOOG-PLAY-004559725.R at -759.R (Google presentation from 2017 stating that "Play benefits from network effects. Users come to Play because we have by far the most compelling catalogue of Apps/games. Developers come to Play because that's where the users are.") *See also* GOOG-PLAY-004508011 at -012 (summary notes from 2019 internal Google brainstorming session stating "[a]n [A]ndroid App cannot ultimately survive as a product or business without being hosted on Play.").

187. *See, e.g.,* Landes & Posner, *supra* at 938 ("The standard method of proving market power in antitrust cases involves first defining a relevant market in which to compute the defendant's market share, next computing that share, and then deciding whether it is large enough to support an inference of the required degree of market power. Other evidence - for example, of the defendant's profits, or of the ability of new firms to enter the market, or of price discrimination - may be presented to reinforce or refute the inference from market shares."). *See also* Simcha Barkai, *Declining Labor and Capital Shares* 75(5) JOURNAL OF FINANCE 2421, 2422 (2020) ("Firms that charge consumers high prices relative to the cost of production have high pure profits…an increase in the pure profit share, equal to the ratio of pure profits to gross value added, is indicative of an increase in market power and a decline in competition.")

188. GOOG-PLAY-001337211 at -225 (October 2010 presentation from Android founder Andy Rubin, other executives).

189. *See, e.g.,* GOOG-PLAY-011607543; GOOG-PLAY-005577045.

190. GOOG-PLAY-004503351.R at -352.R.

191. GOOG-PLAY-004503351.R at -358.R.

192. GOOG-PLAY-004503351.R at -362.R.

193. GOOG-PLAY-004503351.R at -363.R (referencing a "new methodology" that incorporates 2018 data).

194. GOOG-PLAY-004503351.R at -362.R.

[redacted]

85. Similarly, in March 2017, Google's LTV calculations indicated that it earned an incremental [redacted] on Google services over two years from U.S. customers who switched from an iPhone to an Android device, just from the presence of Google services on that device.[195]

II. Google's Monopoly Power In The Android App Distribution Market

86. In this section, I demonstrate that the Android App Distribution Market, defined as the market for the sale and distribution of Apps for Android mobile devices, is a distinct relevant antitrust market. I also demonstrate that Google has monopoly power in this market.

A. The Android App Distribution Market Is a Distinct Relevant Antitrust Market

87. The purchaser of a Google Android device always receives the device with the Play Store pre-installed and its icon prominently displayed. Through the Play Store, consumers can access a broad array of Apps offered by myriad developers. Thus, the Play Store is a two-sided matchmaking platform where Google brings together developers wishing to distribute Apps and

195. GOOG-PLAY-011607543 ('OUTPUT' tab; Cell E:9).

consumers wishing to obtain Apps to use on their Google Android devices.[196] The initial download of an App may be considered the consummation of the matchmaking service, giving rise to an offer (by the developer) and acceptance (by the user). Once an App is downloaded onto the Google Android mobile device, however, the Play Store's matchmaking role for the initial download is at an end—and its contribution to value creation diminishes—because the developer has found the consumer and created its own independent channel of distribution with that consumer by virtue of the installation of the developer's App on the consumer's device. Through its App, the developer now has a direct pipeline to the consumer for both communication and purchases of In-App Content. As discussed more fully below, the Android App Distribution Market and In-App Aftermarket are economically distinct.

88. A two-sided platform matches buyers (in this case consumers) and sellers (in this case App developers). Two-sided platforms benefit from "indirect network effects," meaning that each additional buyer makes the platform more appealing to sellers and vice versa.[197] Buyers wish to transact on the platform with the greatest variety of content to choose from, and sellers wish to reach the largest buyer base possible. In the context of the Android App Distribution Market, Google connects consumers of Apps with developers through the Play Store. The presence of more consumers makes the Play Store more appealing to developers, and the presence of more developers make the Play Store more appealing to consumers. A two-sided platform creates value by harnessing these indirect network effects to increase the number of participants on each side of the platform.

89. By Google's estimate, there were over three billion Android devices in the world as of May 2021.[198] To access this customer base of Android users, developers design Apps for Android devices. To list their Apps, developers pay the Play Store a small up-front fee of $25 and Google keeps a percentage (typically 30 percent) of developers' revenues for paid downloads.[199] Developers traditionally reach users through App stores installed on the users' device, but also can distribute their Apps to consumer devices directly from developer websites through a process known as "sideloading."[200]

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196. There is evidence that this matchmaking function is less relevant for some Apps than others. GOOG-PLAY-004626298 [redacted]

197. *See, e.g.,* David Evans, *Two-Sided Market Definition* in MARKET DEFINITION IN ANTITRUST: THEORY AND CASE STUDIES (ABA Section of Antitrust Law) 1-35, 5 (2009), papers.ssrn.com/sol3/papers.cfm?abstract_id=1396751 ("A key feature of two-sided platforms is the presence of 'indirect network effects.'").

198. Alex Cranz, *There are over 3 billion active Android devices. That's a lot of smartphones*, THE VERGE (May 18, 2021), theverge.com/2021/5/18/22440813/android-devices-active-number-smartphones-google-2021. The author notes this estimate is conservative because the data are "taken from the Google Play Store, which doesn't take into account devices based on Android but that use alternative stores, including Amazon Fire devices…" *Id*.

199. Play Console Help, *How to use Play Console*, support.google.com/googleplay/android-developer/answer/6112435?hl=en#zippy=%2Cstep-pay-registration-fee ("[T]here is a US$25 one-time registration fee[.]").

200. I exclude sideloading from the Android App Distribution Market, although whether or not it is included does not change my conclusion that Google has monopoly power in the Android App Distribution Market. Sideloading is partially an artifact of Google's restraints, as some developers such as Epic pulled their App outside of the Play

90. While the Play Store is pre-installed on every Google Android mobile device, sideloading requires independent consumer knowledge of the developer's website and the circumvention of onerous technical barriers imposed by Google. *See* Part IV.A.4, *infra.* As a practical consequence, the effective Android App Distribution Market consists almost entirely of Android App stores that have been pre-installed on the mobile device. Record evidence indicates that Apps downloaded outside of Play came to just [redacted] percent of Google Android installations globally, and just [redacted] percent of Google Android installations in the U.S.[201]

91. Although App stores, like some other two-sided platforms, benefit from indirect network effects, the market for initial App downloads need not always tend toward monopoly.[202] Without the multiple restrictions that Google has imposed, consumers would have easier access to multiple cross-platform App stores.[203]

1. One-Sided and Two-Sided SSNIP Tests Demonstrate The Android App Distribution Market Is a Relevant Antitrust Market

92. As detailed below, the Android App Distribution Market is a distinct relevant antitrust market under the *Horizontal Merger Guidelines*' SSNIP test. When conducting a SSNIP test, it is important to avoid the cellophane fallacy. In *U.S. v. E.I. Dupont de Nemours*, the Supreme Court failed to infer DuPont's dominant market position in cellophane by erroneously defining the relevant market too broadly. Although DuPont produced 75 percent of the cellophane sold in the United States, the Court found that DuPont lacked market power because cellophane accounted for only about 18 percent of a broader market that included other flexible wrapping materials. Because DuPont had already increased cellophane prices substantially above competitive levels, customers had begun to substitute to non-cellophane products that would not have been considered

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Store to evade Google's excessive take rates, leaving users with no choice but to sideload to access the App. *See* Nick Statt, *Apple Just Kicked Fortnite Off the App Store*, THE VERGE (Aug. 13, 2020), theverge.com/2020/8/13/21366438/apple-fortnite-ios-app-store-violations-epic-payments ("Epic previously bypassed Google's Play Store on Android by releasing Fortnite as a direct download through its own software launcher. But the studio eventually relented earlier this year after failing to appeal Google for an exemption of its similar 30 percent cut of all in-App purchases."). Given the hassles imposed on the user, many of which are imposed by Google (see Part IV.A.4, *infra*), sideloading is presently an inferior substitute to downloading an App from an App store. In addition, for many developers, App stores provide access to a large customer base and increased discovery services, while relying on users to sideload would require substantial the users to learn about the application in the first place. For this reason, the ability of users to sideload (albeit with some friction) does not serve as a substitute for an App store, and sideloading does not discipline Google's use of its power in the App distribution market. Finally, even if one were to assume sideloading could be a viable distribution channel for competing App stores, such as the Amazon Appstore, Google has encumbered this channel with "unknown sources" warnings that dissuade consumers from using it. *See* Part IV.A.4.

201. GOOG-PLAY-004489655.R at -656.R ("Special Topic: Off-Play Installs (a.k.a. Sideloading)"). *See also Id.* at -662.R. Sideloading accounts for approximately [redacted] of all Google Android app installations outside of the Play Store. *Id.* at -656.R.

202. *See, e.g.*, Mark Looi, *On "The Platform Delusion" by Jonathan Knee*, MEDIUM (Dec. 20, 2021), marklooi.medium.com/on-the-platform-delusion-by-jonathan-knee-a787a672b932.

203. Google has produced data calculating the "% sideloaded app" at [redacted] in 2019 and 2020. GOOG-PLAY-001508603 ("Apps by Source"). This does not represent the share of Apps sideloaded by users to avoid the Play Store. The [redacted] statistic is driven by "Apps that are pre-installed on the user's device that do not update through Play[.]" *Id.* According to these data, less than [redacted] of Apps are "downloaded by a user from non-Play sources." *Id.*

substitutes at the competitive cellophane price.[204] As detailed below, all of my SNNIP tests avoid the cellophane fallacy by imposing the SSNIP at the estimated competitive take rate rather than the supracompetitive 30 percent take rate that has Google imposed in the Play Store.

93. As detailed below, the SSNIP test confirms that the Android App Distribution Market is a distinct relevant product market regardless of whether I apply (1) a traditional SSNIP test to each side of the market separately; or (2) a two-sided SSNIP to both sides of the market simultaneously. To begin, I analyze the developers' side of the market:

- In a more competitive but-for world, the headline take rate[205] in the Android App Distribution market would be approximately 22.2 percent. (*See* Table 6, *infra*).

- A hypothetical five percent increase above competitive levels would increase the take rate to approximately 23.3 percent (equal to 0.222 x [1.05]), which is far below Google's 30 percent headline take rate.

- Therefore, Google could (and did) profitably maintain the take rate in the Android App Distribution Market far above competitive levels for the duration of the Class Period.

- Consequently, a (not-so) hypothetical monopolist could profitably impose a SSNIP on the price charged to developers in the Android App Distribution Market.

94. If a hypothetical App-store monopolist that distributed Android Apps were to raise its take rate above competitive levels by a small but significant amount, say by five percent in accordance with the *Guidelines*, developers on the monopoly App store would not stop distributing their Apps through that App store, because the Android App Distribution Market is too large to forgo. Android devices account for 40 percent of the mobile devices purchased in the United States, and 71.5 percent of mobile devices bought globally.[206] Developers cannot earn a profit until the margins on their initial downloads or In-App Content cover the often substantial development and marketing costs.[207] As long as incremental sales of Apps are bringing value to developers and paying down their fixed costs, they would not abandon distribution through the Android platform

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204. *United States v. E. I. du Pont de Nemours & Co.*, 351 U.S. 377 (1956). *See also* Luke Froeb & Gregory Werden, *The Reverse Cellophane Fallacy in Market Delineation*, 7 REVIEW OF INDUSTRIAL ORGANIZATION 241-247, 241 (1992) ("In the landmark Cellophane case, the Supreme Court erroneously concluded that du Pont did not have significant market power because the Court evaluated the elasticity of demand for Cellophane at the monopoly equilibrium, at which the elasticity was far higher than at the competitive equilibrium."); *see also* Landes & Posner at 960-961.

205. For most of the Class Period, the vast majority of developers paid a headline take rate of 30 percent; a small percentage of developers participated in special programs offering a fixed percentage-point discount from the headline take rate. Singer Class Cert Reply ¶¶8-9.

206. Statcounter, *Mobile Operating System Market Share Worldwide*, (accessed Sep. 2022), gs.statcounter.com/os-market-share/mobile/worldwide/#yearly-2019-2019-bar. Android and iOS collectively account for 99.71 percent share, while Windows accounts for 0.02 percent of the mobile operating system market worldwide. Statcounter, *Mobile Operating System Market Share United States of America,* (accessed Sep. 2022), gs.statcounter.com/os-market-share/mobile/united-states-of-america.

207. Saylor Academy, *7.1Development Options and Costs*, Business Information Systems: Design an App for That, Table 7.1 "Various Fixed Costs", saylordotorg.github.io/text_business-information-systems-design-an-app-for-that/s11-01-development-options-and-costs html.

in the event of a small but significant price increase over competitive levels. Further, sideloading is not a commercially viable alternative for most developers and therefore does not constrain Google's pricing.[208]

95. Within the Android App Distribution Market, the Play Store has power in large part because of its broad reach. Record evidence suggests that developers are attracted to the Play Store primarily because of its reach.[209] In 2015, Google asked Dr. Itamar Simonson to "conduct a survey of mobile device application developers."[210] The survey's objectives included "assessing the factors that influence developers' decisions whether to develop applications for a new or existing mobile platform."[211] Dr. Simonson concluded that the "survey findings are consistent with other studies of application developers' decision making and with Google's recognition (as reflected in internal documents) that the volume of developed applications is largely driven by the number of Android users."[212] In short, developers of Android-compatible Apps would be insensitive to a small, but significant, sustained increase in Android App distribution take rates, and hence the Android Application Distribution Market is a distinct relevant antitrust market.

96. Turning to the consumer side, my Discount Model[213] demonstrates that a hypothetical monopolist could profitably decrease the consumer subsidy below competitive levels—that is, charge consumers a higher price for access than competitive levels.

- In a more competitive but-for world, the consumer subsidy would increase from [redacted] (*See* Table 16, *infra*).
- A hypothetical five percent decrease in the consumer subsidy below competitive levels would decrease the subsidy to approximately [redacted] which is far above Google's actual subsidy of [redacted]
- Therefore, Google could (and did) profitably maintain the consumer subsidy far below competitive levels for the duration of the Class Period.

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208. *See, e.g.,* Koh Dep. 50:14-51:5 (During his time at [redacted] *Id*. at 101:21-102:14 (During his time working for developers, they performed cost-benefit analyses regarding distribution via direct download, but it was "too difficult to tell" whether the user reach they would achieve would justify the investment.).

209. *Id.* at 89:25-90:9 (For developers trying to reach new users in the United States, "Google would be the priority just because it has a large volume of users."); *Id.* at 321:19-323:1 [redacted] *Id.* at 324:6-12 (same consideration for the developer [redacted]

210. GOOG-PLAY-007317611 at -613 (Report of Dr. Itamar Simonson, Feb. 8, 2016). Pre-testing was done at the "end of December" 2015. *Id.* at -618. The survey was administered between December 28, 2015 and January 22, 2016. *Id.* at -619.

211. *Id.* at -613.

212. *Id.* at -615.

213. As explained in Part VI.E below, in a more competitive but-for world, Google could increase the discounts offered to consumers to encourage their use of the Play Store, consistent with what is observed in other two-sided markets such as payment cards. My Discount Model analyzes this effect. In addition, my Amazon Discount Model in Part VII.C below estimates aggregate damages based on the Amazon Appstore's generous consumer discounts on Google Android devices.

- Consequently, a (not-so) hypothetical monopolist could profitably impose a SSNIP on the (negative) price charged to consumers.

97. A hypothetical monopolist in the Android App Distribution Market would be able to profitably increase consumer prices above competitive levels. Even if consumers had perfect information about take rates and the restrictions on developers as well as their implications for App prices over the lifecycle of the device (which they do not have in the actual world), very few would switch their device and operating system in response to a small, but significant, difference in the take rate charged to developers by a monopolist App store. That is especially true for Android phone users due to the significantly higher prices of Apple iPhones, which are two to three times as expensive on average as Android phones.[214] A price difference this large would require extraordinary spending by consumers on Android Apps for a five percent increase in the App store take rate to render a switch economically plausible.[215] Further, the vast majority of Android users (nearly 80 percent) keep their Android phones for over a year, and many (nearly 30 percent) keep their phones for over two years.[216] As a result of the factors contributing to lock-in explained in Part I.A.1.b, consumers display a high degree of loyalty to the operating system they have chosen and learned, and they would not switch devices due to a small, but significant, increase in the take rate or associated App price for Android App distribution.[217]

98. Finally, I apply a two-sided SSNIP to both sides of the market simultaneously by assessing the profitability of a hypothetical increase in total price paid by both sides of the market:

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214. Amit Chowdhry, *Average iPhone Price Increases To $687 and Android Decreases To $254, Says Report*, FORBES (Feb. 3, 2015), forbes.com/sites/amitchowdhry/2015/02/03/average-iphone-price-increases-to-687-and-android-decreases-to-254-says-report/?sh=d9bcd17539e4.

215. A 2021 survey found that only 5.2 percent of users chose "better prices" as a reason why Android users would consider switching to an iPhone. This implies that the switch would be unlikely and uneconomic for most, regardless of whether "better prices" meant better prices for the device or for the Apps. Among the other reasons were "[l]onger software support," "Apple ecosystem integration," and "[b]etter privacy protection." *See* Abhin Mahipal, *Survey: 18% of Android users would consider switching to iPhone 13, but this is down 15% from last year*, SELLCELL (Aug. 31, 2021), sellcell.com/blog/survey-18-percent-of-android-users-would-consider-switching-to-iphone-13/.

216. Consumer Intelligence Research Partners, *How Long Do Android Users Own an Android Phone* (Sep. 21, 2016), files.constantcontact.com/150f9af2201/a238f4a1-5b70-4853-b21e-226c94104d30.pdf. It bears noting that these data are from 2016, and the trend across all devices is to keep phones for even longer periods. *See* Abigail Ng, *Smartphone users are waiting longer before upgrading — here's why*, CNBC (May 17, 2019), cnbc.com/2019/05/17/smartphone-users-are-waiting-longer-before-upgrading-heres-why.html. ("In 2016, American smartphone owners used their phones for 22.7 months on average before upgrading. By 2018, that number had increased to 24.7."). *See also* GOOG-PLAY-007745710 at -740—741, a May 2021 slide deck titled "Google Play: Role in driving Android Retention" (When referring to "Baseline Android Churn," Google estimates that "0.05% of users switch to iOS in a given month" and refers to the process of identifying these switchers as "looking for a tiny needle in a large hay stack").

217. *See, e.g.,* Chuck Jones, *Apple's iOS Loyalty Rate Is Lower Than Google's Android, But Apple May Steal More Users Each Year*, FORBES (Mar. 10, 2018), forbes.com/sites/chuckjones/2018/03/10/apples-ios-loyalty-rate-is-lower-than-googles-android-but-apple-may-steal-more-users-each-year/?sh=29b39ae68a8e ("Loyalty is also as high as we've ever seen, really from 85-90% at any given point. With only two mobile operating systems at this point, it appears *users now pick one, learn it, invest in Apps and storage, and stick with it*.") (emphasis added). *See also* Consumer Intelligence Research Partners, *Mobile Operating System Loyalty: High and Steady* (Mar. 8, 2018), files.constantcontact.com/150f9af2201/4bca9a19-a8b0-46bd-95bd-85740ff3fb5d.pdf ("CIRP finds that between Android and iOS, loyalty to each has remained steady since early 2016, at the highest levels seen. Android has a 91% loyalty rate, compared to 86% for iOS, measured as the percentage of customers that remain with each operating system when activating a new phone over the twelve months ending December 2017.").

- The Android App Distribution is a two-sided transaction market.

- In a two-sided transaction market, a SSNIP can be implemented by determining whether a hypothetical monopolist could profitably increase the *sum* of the prices paid for the transaction by both parties above competitive levels.

- In a competitive but-for world, the total transaction price in the Android App Distribution Market would be approximately [redacted] (*See* Table 6; equal to the competitive App price of [redacted] multiplied by the competitive take rate of [redacted]

- In the actual world, Google's total transaction price in the Android App Distribution Market was approximately [redacted] (*See* Table 6; equal to the actual App price of [redacted] multiplied by the actual take rate of [redacted]

- Put differently, Google's actual total transaction price in the Android App Distribution Market is approximately [redacted] percent above the competitive price (equal to [redacted]

- Google could (and did) profitably maintain the total transaction price far above competitive levels for the duration of the Class Period.

- Consequently, a (not-so) hypothetical monopolist could profitably impose a SSNIP on the total transaction price in the Android App Distribution Market.

99. In sum, analyzing whether there is an Android App Distribution Market from both the developer and consumer perspectives or both sides simultaneously leads to the conclusion that it is a distinct relevant antitrust market. Any competition that might exist between Google and Apple with respect to the device or ecosystem does not significantly constrain Google's ability to extract supra-competitive prices in the Android App Distribution Market. That Apple[219] (in November 2020) and Google[220] (in March 2021) lowered take rates for small developers to 15 percent within a few months of each other does not imply one take-rate reduction was caused by the other, nor does it imply that their two App stores significantly discipline each other's prices (for developers) and thus are in the same product market. The moves came just after antitrust lawsuits were filed in August 2020, and Congress published a report on the platforms' conduct in

218. More precisely, Google's total transaction price in the Android App Distribution market was approximately [redacted]

219. Kif Leswing, *Apple will cut App Store commissions by half to 15% for small App makers*, CNBC (Nov. 18, 2020), cnbc.com/2020/11/18/apple-will-cut-app-store-fees-by-half-to-15percent-for-small-developers html (describing the take-rate decrease as a "high-profile olive branch from Apple to lawmakers.").

220. Chaim Gartenberg, *Google will reduce Play Store cut to 15 percent for a developer's first $1M in annual revenue*, THE VERGE (Mar. 16, 2021), theverge.com/2021/3/16/22333777/google-play-store-fee-reduction-developers-1-million-dollars.

October 2020.[221] Internal Google documents also suggest that the decision to reduce its take rate on small developers was driven at least in part by public-relations and regulatory considerations.[222]

100. I understand that Professor Presser will present survey evidence indicating that only a very small proportion of U.S. Android phone users would switch to an Apple phone in response to a five percent increase in the price of Apps and In-App Content.[223]

2. Devices Such as PCs and Gaming Consoles Do Not Expand The Relevant Market

101. Devices such as PCs and gaming consoles do not expand the Android App Distribution Market, for the same reasons that they do not expand the market for mobile OSs, as explained in Part I.A.4 above.

102. In addition, as described in more detail in Part VI.B.5, the Epic Games Store[224] and Microsoft[225] have both charged developers a twelve percent take rate on their respective PC game platforms. That this large disparity in take rates persists implies that developers perceive the Play Store to be a unique outlet, and developers are beholden to Google to reach their critical audience of consumers. And Google has not changed its pricing in response to changes in take rates from Microsoft, console makers, or the Epic Store.

3. Streaming Apps and Web Apps Do Not Expand the Relevant Market

103. In addition to native apps, Android users may also access mobile games through web-based apps or game-streaming platforms. Web-based apps are apps that reside on the Internet outside of an App store. Users access these apps directly in a mobile device browser. Game-streaming platforms provide users access to a library of games by streaming the games from a remote cloud server to the user's device.[226] Game-streaming platforms may be accessed from PCs,

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221. *Id.* ("The new policy also comes at a critical moment when Google (and Apple's) App store policies are under intense public scrutiny, kicked off by the removal of Epic Games' *Fortnite* from both the App Store and Play Store and the game developer's subsequent antitrust lawsuits against Apple and Google.").

222. Google's documents suggest that its decision in March 2021, to reduce its take rate to 15 percent for the first $1 million in developer revenue was driven at least in part by public-relations considerations. *See* GOOG-PLAY-007317535 ("Play Store Global Research[:] All Markets Findings"); *See also* GOOG-PLAY-007317521 ("Play Store Global Research[:] India Findings"); GOOG-PLAY-007317528 ("Play Store Global Research[:] South Korea Grasstop Findings").

223. Presser Report at 7-9.

224. Epic Press Release, *The Epic Games store is now live*, (Dec. 6, 2018), epicgames.com/store/en-US/news/the-epic-games-store-is-now-live ("The Epic Games store is now open, featuring awesome high-quality games from other developers. Our goal is to bring you great games, and to give game developers a better deal: they receive 88% of the money you spend, versus only 70% elsewhere. This helps developers succeed and make more of the games you love.").

225. Tom Warren, *Microsoft shakes up PC gaming by reducing Windows store cut to just 12 percent*, THE VERGE (Apr. 29, 2021), theverge.com/2021/4/29/22409285/microsoft-store-cut-windows-pc-games-12-percent.

226. Jacob Roach and Kevin Parrish, *What is cloud gaming?*, DIGITAL TRENDS (Mar. 29, 2021), digitaltrends.com/gaming/what-is-cloud-gaming-explained/.

consoles, or mobile devices.[227] When accessed via mobile devices, game-streaming platforms may run through a native App or through a mobile browser.[228]

104. These "Web-based apps" do not expand the relevant market. According to Google's documents, web-based apps are not close substitutes from the consumer's perspective to a traditional native app.[229] Traditional Apps are typically installed on the home screen and provide users with what Google considers to be the "preferred/guaranteed experience."[230] Some traditional Apps can support "offline mode" or can be used without an Internet connection.[231] In most cases, after a traditional App is launched, the user is returned to the place where she left,[232] another significant benefit. "Web apps," by contrast, began simply as bookmarked links to the web version of an app, opened in a browser.[233] Unlike traditional—or "native"—Apps, these web apps require an internet connection,[234] perform slower than native Apps,[235] cannot access useful native functions (e.g., the phone's camera),[236] and do not show up in the Android App launcher.[237] According to Google, even the next generation of "progressive web apps," which address some of these shortcomings, still "falls short on some native interactions, including smooth animation transitions, native gestures, native menus, [and] material UI Guidelines."[238] As the House Judiciary Committee's Investigation of Competition in Digital Markets concluded, "Websites and web apps are not competitively significant alternatives to the dominant [A]pp stores on iOS and Android devices for distributing software to mobile devices. Apps provide a deeper, richer user experience and can provide additional functionality by accessing features within the mobile device's hardware and operating system, such as camera or location services."[239] Web-based apps are no substitute for apps on the Play Store in the Android App Distribution Market.

105. Game-streaming platforms also do not constrain Google's pricing on the Play Store. As an initial matter, game-streaming platforms are focused on gaming, so they do not provide a substitute for the wide range of the applications available in the Play Store, including most or all non-gaming Apps. Moreover, game-streaming is in its infancy. The user base remains small – one 2020 Google presentation estimated the "nascent" game-streaming model would amount to [redacted] of mobile gaming revenue by 2023.[240] In 2019, it represented [redacted] percent of mobile games revenue.[241] For most of the Play Store's history, game-streaming has not been a meaningful market alternative.

227. *Id.*
228. *Id.*
229. GOOG-PLAY-001882239.
230. *Id*. at -256.R.
231. *Id*.
232. *Id*. at -257.R.
233. *Id*. at -261.R.
234. *Id*. at -264.R.
235. *Id*.
236. *Id*. at -265.R.
237. *Id*. at -263.R.
238. *Id*. at -274.R.
239. *Investigation of Competition in Digital Markets, Final Report and Recommendations,* H.R. Subcommittee on Antitrust, Commercial and Administrative Law of the Committee on the Judiciary (2021) at 96, https://docs.house.gov/meetings/JU/JU00/20210414/111451/HMKP-117-JU00-20210414-SD001.pdf.
240. GOOG-PLAY-004693144.R at -190.R.
241. *Id.*

106. Record evidence indicates that technology has not advanced to a point where game-streaming on mobile devices offers an economic substitute to mobile gaming. Unlike native Apps, mobile game-streaming requires that a user maintain a high-quality internet connection throughout the gameplay experience. For instance, Amazon's game-streaming service, Amazon Luna, recommends that users stream games via a wired connection—and, if accessing the service via a wireless device, use a 5G data connection.[242] While Donn Morrill, Director of Developer Relations at Amazon, testified that "[i]n certain cases a cellular connection be sufficient" for a user to play Luna games from their mobile device, he explained that "it depends on how much data the game is transmitting to the cloud and how frequently it does it and how latency sensitive that game is."[243] Since Epic launched Fortnite on Nvidia's GeForce Now and Microsoft's Xbox Cloud service, both leading game-streaming platforms,[244] Epic VP of Business Joe Kreiner found that streaming was "not a significant driver of growth."[245] He attributed this low growth to users' limited access to sufficiently high-quality Internet connections and the fact that mobile gamers typically want to play games on the go.[246]

107. Moreover, even with high quality Internet connections, streaming introduces "latency" in the gameplay experience that limits the ability for these services to substitute native App gameplay. Mr. Morrill testified that Amazon cannot fully eliminate latency from its Luna streaming service because of the necessity of transmitting users' inputs and the responsive game outputs, calling it a "speed of light problem."[247] One commentator from CNET wrote in 2021, "The first few steps in many cloud games feel great… and… then… the… lag… sets… in. . . . Or you're not experiencing any game-breaking lag, but the service indicates you've got network issues, which pulls you out of the experience."[248] This commentator concluded, "Despite leaps in technology and big names like Google, Nvidia and Amazon, streaming games like you do Netflix movies is still a rough experience."[249]

108. Game-streaming platforms themselves recognize that their services do not provide a substitute for mobile gaming. One game-streaming app, Big Fish, explained in communications with Apple, that games streaming "is complementary, not competitive to native apps …. Our data from many thousands of current subscribers on PC and Android show that streaming games is a great way to explore and discover content, however it is not a substitute for owning native apps."[250]

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242. Morrill Dep. 459:23-460:20 ("Q: It's true, isn't it, that Amazon recommends Luna users use Luna on a wired network, right? . . . A: Okay. Well, then as of two days ago that appears to be the recommendation, yes.").

243. *Id.* at 447:12-22.

244. *See* Nick Fernandez, *Google Stadia vs GeForce Now: Which game-streaming service is right for you?*, ANDROID AUTHORITY (Jan. 21, 2022), androidauthority.com/google-stadia-vs-geforce-now-1080793/; Nick Fernandez, *Xbox Cloud Gaming: Everything you need to know about the service*, ANDROID AUTHORITY (June 22, 2022), androidauthority.com/xbox-cloud-gaming-1205717/.

245. Kreiner Dep. 404:15-406:25.

246. *Id.* (attributing low growth in users from mobile game-streaming to "the technical limitations of streaming services in that you have to have an excellent Internet connection" and fact that Android users are "mobile and moving around, not necessarily at home, and those are less than ideal conditions to play on a streaming service").

247. Morrill Dep. 449:10-15 ("Q. You can't late latency entirely when you are playing a cloud streaming game, can you? MR. MUNDEL: Beyond the scope. A. It's what we call a speed of light program, no, you can't.").

248. Dan Ackerman, *5 reasons cloud gaming isn't doing it for me -- yet*, CNET (Feb. 19, 2021), cnet.com/tech/computing/5-reasons-cloud-gaming-isnt-doing-it-for-me-yet/.

249. *Id.*

250. APL-Goog_00394970 at -970—971.

In theory, game-streaming platforms might one day comprise a significant segment of the mobile gaming market, but they are not currently a substitute for mobile gaming in native Apps.

B. The Relevant Geographic Android App Distribution Market Is Global (Excluding China)

109. A (not so) hypothetical monopolist over the Android App Distribution Market worldwide (excluding China) could profitability exercise market power over developers and consumers. As explained in Part I.A.1.b and Part I.A.1.c, and exercise of market power could not be defeated by switching to Apple devices. Nor could the exercise of market power be defeated by switching to alternatives such as PCs and gaming consoles, as explained in Part I.A.4 above. Nor could it be defeated by limiting operations to China: Developers distributing only in China would not be able to reach consumers in the rest of the world; the hypothetical monopolist could identify a user's geographic location, and thus could withhold distribution services to customers outside China.

110. It is possible that a hypothetical monopolist in the Android App Distribution Market in the United States alone could profitably exercise market power. For purposes of my analysis here, it is not necessary to limit the geographic market to the United States, given the global reach of Google's monopoly power and the Challenged Conduct.

C. Google's Market Power in the Android App Distribution Market

111. This section begins by describing evidence that directly demonstrates Google's market power in the Android App Distribution Market. I also use indirect evidence—high market shares and entry barriers—to establish that Google has market power.

1. Direct Evidence: Ability to Exclude Rivals

112. A classic hallmark of market power is the ability to exclude or impair rivals.[251] Record evidence indicates that Google has done exactly that in the Android App Distribution Market. As detailed below, Google has used anticompetitive means to impair competitors, including economic incentives and technical barriers to exclude or impair potential competitors—including Amazon, Facebook, Epic, and other prominent App developers—from effectively deploying competing App stores.

113. The Amazon Appstore was launched in 2011. A Google "Market Strategy" presentation prepared that year proposed that Google "leverage [its] dominant position to prevent Amazon and other small players from gaining critical mass" in App distribution.[252] In 2013, Google offered to make Amazon's Kindle App the default book service for Google Android—if, in return, Amazon agreed to use Google Play as the default App store on Amazon devices, and to

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251. *United States v. E. I. du Pont de Nemours & Co.* ("*Cellophane*"), 351 U.S. 377, 391 (1956) (A firm has market power if it possesses "the power to control prices or exclude competition."). *See also* Baker & Bresnahan at 15. *See also* Thomas Krattenmaker, Robert Lande & Steven Salop, *Monopoly Power and Market Power in Antitrust Law*, 76 GEORGETOWN L.J. 241 (1987).

252. GOOG-PLAY-004223307 at -322.

"stop investing in its own App store."[253] Amazon did not agree to these terms.[254] In 2015, Amazon released a version of Amazon Shopping App on Google Play that also included the Amazon Appstore.[255] According to press coverage at the time, "The move effectively turns Amazon's flagship application—an App that has somewhere between 50 million and 100 million installs, according to Google Play's data for the smartphone version—into an App store App that directly competes with Google Play, while also being sold on Google Play."[256] Google promptly required Amazon to shut down the Amazon Appstore inside the Amazon Shopping app, citing contracts prohibiting the distribution of apps on Play that distribute other apps.[257]

114. [redacted][258] [redacted][259] [redacted][260] [redacted][261] [redacted]

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253. [redacted]

254. [redacted]

255. [redacted]

256. GOOG-PLAY-000832219 at -221

257. Google's Jamie Rosenberg made this clear in an email to Sameer Samat on March 14, 2015. GOOG-PLAY-000832219 ("New downloads of the Amazon Mobile [A]pp (as of 12/12) would not have App Store functionality."). *See also* Morrill Dep. 181:1-15 ("Q. Okay. Did Amazon release Snuffy on the Google Play Store? A. We did, yes. Q. What, if anything, did Google do in response to Amazon launching Snuffy on the Google Play Store? A. . . . [I]n general, Snuffy was ultimately disallowed. Q. Disallowed by whom? A. By the policies of the Google Play Store.").

258. [redacted]

259. AMZ-GP_00005523.

260. *Id.*

261. *Id.*

[redacted]

115. As explained in Part VI.B.5.c below, Amazon has offered [redacted] consumer subsidies such as Amazon Coins. Amazon Coins is a currency that provides a direct consumer subsidy by enabling Amazon Appstore users to purchase apps or in-app content at a discounted price.[264] Programs such as Amazon Coins provided direct consumer subsidies of approximately [redacted] percent of consumer expenditure in the Amazon Appstore when accessed via Google Android devices. [redacted].[267] That discounts of [redacted] were insufficient to make the Amazon Appstore a more effective competitor provides further evidence of Google's ability to exclude rivals.

116. As detailed in Part IV.A.3.b below, Google's Project Hug secured content from some of the largest developers, preventing them from giving competing stores the exclusive content necessary to help drive usage, and imposed price and content parity requirements for certain developers. Project Hug impaired entry and expansion by competing App stores, and provides further evidence of Google's ability to exclude rivals.

117. As detailed in Part IV.A.3.c below, I understand that Google may have used the threat of technically disrupting Facebook's updating capabilities to secure a long-lasting commitment from Facebook not to deploy a competing App store. Although I am not opining on the existence of such an agreement, if the fact finder determines that such an agreement was in place, it likely would have generated anticompetitive effects.

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262. [redacted]

263. Sarah Perez, *Amazon is shutting down its 'Underground Actually Free' program that gives away free Android apps*, TECH CRUNCH (April 28, 2017), techcrunch.com/2017/04/28/amazon-is-shutting-down-its-underground-actually-free-program-that-gives-away-free-android-apps/.

264. *Amazon Coins Basics*, Amazon, : https://www.amazon.com/b/ref=s9_acss_bw_cg_masfr_1b1_w?node=21428594011&pf_rd_m=ATVPDKIKX0DER&pf_rd_s=merchandised-search-1&pf_rd_r=1FAV02E1JX4P7C7R35K7&pf_rd_t=101&pf_rd_p=5072b22c-b33c-4c93-898a-6716fe966ef4&pf_rd_i=21435619011 ("You can buy Amazon Coins bundles for a discounted price exclusively from Amazon. Using Coins, you can save on eligible games and in-app items sold by Amazon Appstore. Preload your account with Coins to save time (and money!) when making in-app purchases. 100 Amazon Coins are worth $1.00 in value. You can see the Coins discounts on the Buy Coins web page. The more Coins you buy, the bigger the discount.")

265. AMZ-GP_00002484 at -2488.

266. AMZ-GP_00001672.

267. AMZ-GP_00002484 at -2488.

118. That Google profitably imposed a 30 percent take rate on developers for most paid App downloads is direct evidence of its market power over developers in the Android App Distribution Market. As shown in Part VI.B.5, *infra*, this take rate is high relative to competitive benchmarks. In the presence of competition, developers would be able to offer their Apps on Android devices through multiple App stores; a developer unwilling to pay a 30-percent take rate could choose to market and distribute its App on a competing App store without losing access to most customers.

119. Google considered adjustments to its business model and to its take-rate levels, including “progressive rev-share rates,” in which Google would “change the fundamental Play biz model for dev[elopers],” by allowing the take rate to fall over time.[268] The pressure to reduce take rates would come from OEMs capable of “building significant distribution scale” and from game developers with “highly monetizing titles,” presenting an “increasing risk of going-it-alone.”[269] Google observed that the obvious downside of reducing the take rate is that it would decrease profit margins,[270] and questioned whether any reduction should be done at all.[271] Since the (undated) presentation, which refers to 2018 Search and Play revenues,[272] Google has done little to lower take rates (outside of rates for subscriptions and small developers).

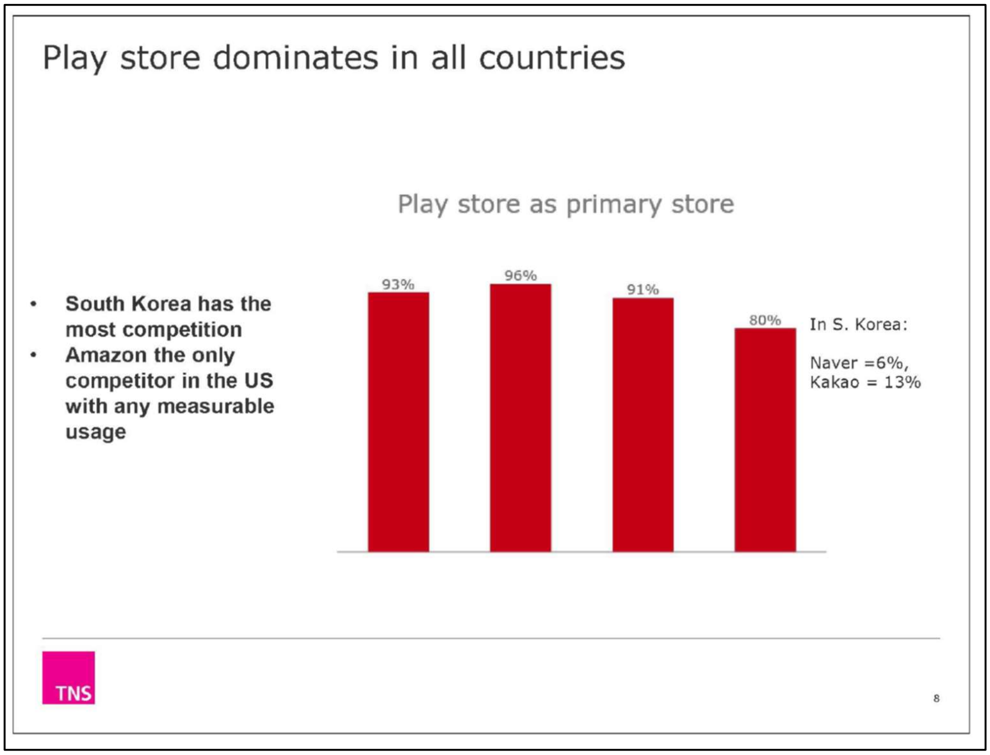
2. Indirect Evidence

a. High Market Share and Entry Barriers

120. Google’s power in the Android App Distribution Market can also be gleaned indirectly via its high market shares and entry barriers.[273] As seen below, according to a “Competitive Usage Survey,”[274] the Play Store enjoys market shares of over 90 percent in the United States, Brazil, and India. Google Play’s market share is a dominant 80 percent even in South Korea, where it faced more competition than in other countries. The document lists Amazon as “the only competitor in the U.S. with any measurable usage.”[275] [redacted]7

268. GOOG-PLAY-000443763.R. at -775.R.
269. *Id*. at -774.R.
270. *Id*. at -776.R.
271. *Id*. at -776.R-777.R.
272. *Id*. at -770.R.
273. Entry barriers tend to eliminate the possibility a competitive fringe can readily and substantially increase production in response to a small increase in the incumbent’s price. *See, e.g.,* Landes & Posner *supra*, at 947.
274. GOOG-PLAY-001886111.R.
275. GOOG-PLAY-001886111.R at -118.R.
276. AMZ-GP_00002484 at -2488.
277. AMZ-GP_00001672.

FIGURE 7: MARKET SHARES, GOOGLE PLAY COMPETITIVE USAGE SURVEY (CIRCA 2016)



Source: GOOG-PLAY-001886111.R at -118.R (undated presentation; metadata indicate document created in 2016; other slides in the presentation indicate the four bar graphs, from left to right, represent the United States, Brazil, India, and South Korea).

121. As of October 2021, a total of over 21.6 billion Apps had been downloaded from the Play Store.[278] Excluding China, where the Play Store is blocked,[279] "Apple and Google control more than 95 percent of the app store market share through iOS and Android…The [a]pp economy was built on these two platforms[.]"[280] According to a 2020 Google Board of Directors Update, "Android has [an] 85% share of global smartphones, with over 2.4B active devices."[281] Due in part to the massive installed base of mobile Android devices, significantly more apps are downloaded from the Play Store than from the Apple App Store. For example, in 2020, there were approximately 108.5 billion downloads from the Play Store, compared with 34.4 billion through

278. Terry Stancheva, *17 App Revenue Statistics – Mobile Is Changing the Game in 2022*, TECHJURY, (Jun. 3, 2022), techjury.net/blog/app-revenue-statistics/#gref (citing Statista).

279. Sherisse Pham, *Google now has two Apps in China, but search remains off limits*, CNN BUSINESS, (May 31, 2018), money.cnn.com/2018/05/31/technology/google-in-china-files-app/index html ("The company's own App store, Google Play, remains blocked in China[.]").

280. David Curry, *App Store Data (2022)*, BUSINESS OF APPS, (Jan. 11, 2022), www.businessofApps.com/data/app-stores/

281. GOOG-PLAY-001018676.R at -689.R.

Apple App Store.[282] Excluding China, the Play Store accounted for over 80 percent of the combined global downloads from the Play Store and the Apple App Store in 2020.[283]

122. Data from industry analysts on mobile app expenditures (which aggregates consumer expenditures on both initial downloads and in-app purchases) confirm (1) that the Play Store and the Apple App Store account for the vast majority of mobile app expenditures outside China; and (2) that the Play Store alone accounts for the vast majority of mobile app expenditures outside China and distinct from iOS. In light of the global dominance of the Play Store and the Apple App Store, industry reports covering mobile apps often focus almost exclusively on these two platforms.[284] But even when other platforms are considered, the data confirm that the Play Store and the Apple App Store account for the vast majority of mobile app expenditures outside of China. For example, global consumer expenditures in Apple's App Store outside of China in 2018 were $32.9 billion,[285] while global consumer expenditures in the Play Store (all of which is outside of China) came to $25 billion in 2018.[286] Global mobile app expenditures outside of China in 2018 were $62 billion.[287] Therefore, outside of China, the Apple App Store and the Play Store accounted for 93.4 percent of global mobile app expenditures as of 2018 (equal to [$32.9 billion + $25.0 billion]/[$62 billion]). Using the same statistics, the Play Store accounted for 85.9 percent

282. David Curry, *App Data Report,* BUSINESS OF APPS (2022) at 16-17 (showing 34.4 billion downloads via iOS and 108.5 billion via Google Play).

283. According to Sensor Tower, The Play Store's total global downloads in 2020 (excluding China) were 108.759 billion (6.3 billion + 22.5 billion + 5.7 billion + 2.8 billion + 21.1 billion + 49.9 billion + 459 million = 108.759 billion). *See* Sensor Tower, *2021 – 2025 Mobile Market Forecast* (2021) at 15. The Apple App Store's total global downloads in 2020 were 34.297 billion (8.9 billion + 2.0 billion + 312 million + 1.3 billion + 7.3 billion + 13.9 billion + 585 million = 34.297 billion). *Id* at 14. 8.2 billion of these downloads come from China. *Id* at 31. Therefore, in 2020, the Play Store accounted for over 80.6 percent combined global downloads from the Play Store and the Apple App Store (equal to 108.759 billion / (108.759 billion + 34.297 billion – 8.2 billion)). Note that consumer expenditures in the Apple App Store exceed those in the Play Store, despite the fact that far more Apps are downloaded through the Play Store. *See, e.g.,* David Curry, *App Data Report* at 29 ("Even though Google Play has a larger installed base and 75% of all Apps are downloaded on the platform, Apple's App Store leads the way in revenue."). Download statistics differ from consumer expenditure statistics in at least two important ways. *First*, many Apps are downloaded free of charge. *Second*, industry data on consumer expenditures consolidates consumer expenditures on initial downloads with consumer expenditures on in-App purchases. *See, e.g., Id.* at 30 (showing aggregate "iOS App and Game Revenues" of $72 billion in 2020); *see also* Sensor Tower, *2021 – 2025 Mobile Market Forecast* (2021) at 36 (also showing a total of $72 billion in 2020 for "App Store Spending" on "Apps" and "Games"; explaining that "[d]riven by the significant success of the *in-App subscription model*, App revenue increased 4.7x between 2016 and 2020, compared to an increase of 2x for games.") (emphasis added). Note also that, based on the Play Store's financials, the vast majority of Play Store revenue comes from Apps and In-App purchases, as opposed to TV/Movies. *See, e.g.*, GOOG-PLAY-010801682 (showing [redacted] percent of 2021 Play Store revenue came from Apps and games).

284. *See, e.g.,* Stephanie Chan, *Global Consumer Spending in Mobile Apps Reached $133 Billion in 2021, Up Nearly 20% from 2020,* SENSOR TOWER (Dec. 2021), sensortower.com/blog/app-revenue-and-downloads-2021 (reporting "Global Consumer Spending in Mobile Apps and Games" as the sum of Google Play and the App Store). *See also* David Curry, *App Data Report*; Sensor Tower, *2019 – 2023 Mobile Market Forecast* (2019).

285. In 2018, global consumer expenditures reached $47 billion in the Apple App Store. *See* Sensor Tower, *2019 – 2023 Mobile Market Forecast* (2019) at 4. Consumer expenditures in the Apple App Store in China were $14.1 billion in 2018. *Id.* at 15. Therefore, non-China Apple App Store expenditures in 2018 were $47 billion - $14.1 billion = $32.9 billion.

286. *Id.* at 4. Consumer expenditures on Apple's App Store exceed those in the Play Store despite the Play Store's larger installed base because Apple's customer base skews toward higher-income users who spend more on Apps and In-App Content.

287. *See* David Curry, *App Data Report* at 44 (showing 2018 non-China revenue of $20 billion (United States) + $15 billion (Japan) + $11 billion (Europe) + $16 billion (Rest of World) = $62 billion).

of non-Apple mobile app expenditures outside of China in 2018 (equal to [$25.0 billion]/[$62 billion - $32.9 billion]).

123. In 2020, global consumer expenditures in Apple's App Store outside of China came to $52 billion,[288] while global consumer expenditures in the Play Store (all of which is outside of China) came to $39 billion in 2020.[289] Global mobile app expenditures outside of China in 2020 were $95 billion.[290] Therefore, outside of China, the Apple App Store and the Play Store accounted for 95.8 percent of global mobile app expenditures as of 2020 (equal to [$52 billion + $39 billion]/[$95 billion]). Using the same statistics, the Play Store alone accounted for 90.7 percent of non-Apple mobile app expenditures outside China in 2020 (equal to [$39 billion]/[$95 billion - $52 billion]).

124. Similarly, statistics on downloads (as opposed to consumer expenditure) indicate that the Play Store's share of the non-China Android App Distribution Market can be estimated at over 90 percent.[291] Nearly 60 percent of non-iOS apps downloaded worldwide in 2020 were downloaded through the Play Store,[292] but this estimate vastly understates the Play Store's share of Android downloads, as the denominator includes downloads in China, where the Play Store is blocked. Removing non-iOS downloads in China would likely place the Play Store at over 90 percent of the non-China Android App Distribution Market. For example, if iOS downloads

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288. In 2020, global consumer expenditures reached $72 billion in the Apple App Store. *See* Sensor Tower, *2021 – 2025 Mobile Market Forecast* (2021) at 6. Consumer expenditures in the Apple App Store in China were $20 billion in 2020. *Id.* at 22. Therefore, non-China Apple App Store expenditures in 2020 were $72 billion - $20 billion = $52 billion.

289. *Id.* at 6.

290. *See* David Curry, *App Data Report* at 44 (showing 2020 non-China revenue of $32 billion (United States) + $20 billion (Japan) + $14 billion (Europe) + $29 billion (Rest of World) = $95 billion).

291. As explained above, download statistics differ from consumer expenditure statistics in at least two important ways. *First*, many Apps are downloaded free of charge. *Second*, as explained above, industry data on consumer expenditures aggregates consumer expenditures on initial downloads with consumer expenditures on in-App purchases.

292. According to Statista, the total number of App downloads in 2021 was 230 billion, with the Play Store and iOS accounting for 144.4 billion. Statista, *Number of mobile Apps downloaded worldwide from 2016 to 2021*, statista.com/statistics/271644/worldwide-free-and-paid-mobile-app-store-downloads/; Statista, *Combined global Apple App Store and Google Play Store App downloads from 1st quarter 2015 to 2nd quarter 2022*, statista.com/statistics/604343/number-of-apple-app-store-and-google-play-app-downloads-worldwide/. The Play Store was responsible for 108.5 billion downloads in 2020 and iOS had 34.4 billion, for a total of 142.9 billion. *See* Mansoor Iqbal, *App Download Data (2022),* BUSINESS OF APPS, (Aug. 31, 2022), businessofApps.com/data/app-statistics/ [hereafter *App Download Stats*]. This implies that the Play Store was responsible for 59 percent of the non-iOS downloads worldwide. In 2020, there were 183.6 billion non-iOS downloads (218 billion less 34.4 billion) and 108.5 billion Play Store downloads. Dividing 108.5 by 183.6 yields 0.59.

account for one quarter of all mobile downloads in China,[293] then the Play Store's share of the non-China Android App Distribution Market would be 97 percent.[294]

125. Internal Google documents show that on Android devices outside of China the Play Store accounts for the vast majority of monthly OEM App store visits and time spent in App stores.[295] According to a 2019 Google slide deck titled "OEM App Store Share Analysis," 94 percent of global monthly Android App store visits outside of China are to the Play Store.[296] As seen below, the Samsung Galaxy Store accounts for just two percent of total monthly OEM App store visits. Other OEM App stores also have trivial market shares in comparison to the Play Store. Even when these statistics are broken out by geographic area, "[f]or each region, the majority (>90%) of all App store visits in a month are to Play Store."[297]

293. *See* Statista, *Market share of mobile operating systems in China from January 2013 to December 2021**, statista.com/statistics/262176/market-share-held-by-mobile-operating-systems-in-china/ (In October, November, and December of 2021, iOS accounted for 18.99, 19.28, and 21.08 percent of mobile operating systems in China, respectively. In the last quarter of 2021, Apple accounted for approximately (18.99 + 19.28 + 21.08)/3 = 19.8% of mobile operating systems in China.) I conservatively set the percentage to 25 percent for purposes of my calculations here.

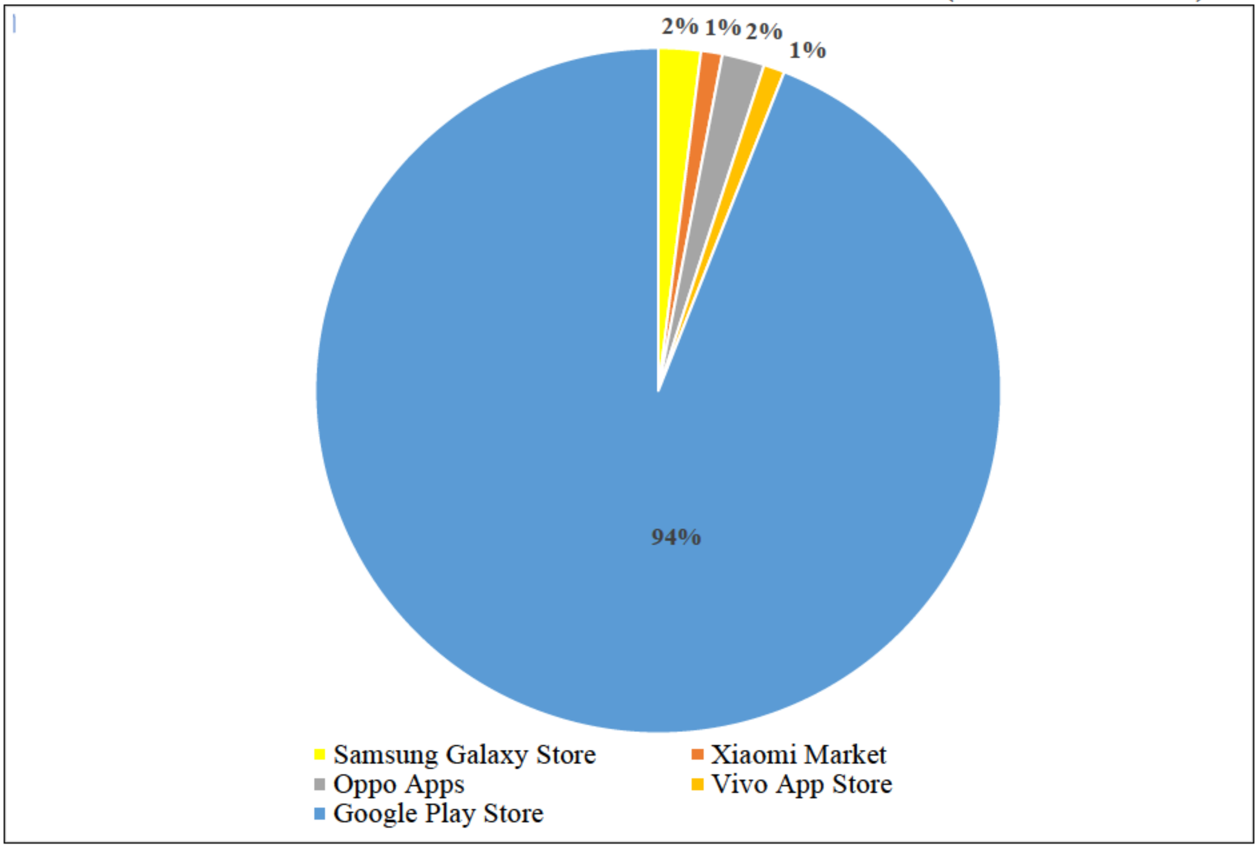
294. There were 96.2 billion downloads in China in 2020. *See App Download Stats*, *supra*. Assuming one quarter of those were iOS, then non-iOS downloads in China would be 72.15 billion (equal to 96.2 billion * (1 – 1/4)). Therefore, total worldwide non-iOS downloads outside China would amount to 183.6 billion – 72.15 billion = 111.45 billion. The Play Store share of the non-China Android App Distribution Market would then equal 108.5 billion / 111.45 billion = 0.97.

295. *See* GOOG-PLAY-002076224.R (Google 2019 slide deck titled "OEM App Store Share Analysis", summarizing global analysis of Android App store visits (excluding China) as follows: "For each region, the majority (>90%) of all [A]pp store visits in a month are to Play Store.") *Id.* at -229.R. Google's analysis also shows that the Play Store accounts for approximately 95 percent of monthly App store time spent of Android App stores worldwide excluding China. *Id.* at -236.R.

296. *Id.* at -229.R.

297. *Id.* at -229.R.

FIGURE 8:
DISTRIBUTION OF VISITS TO ANDROID OEM APP STORES WORLDWIDE (EXCLUDING CHINA)

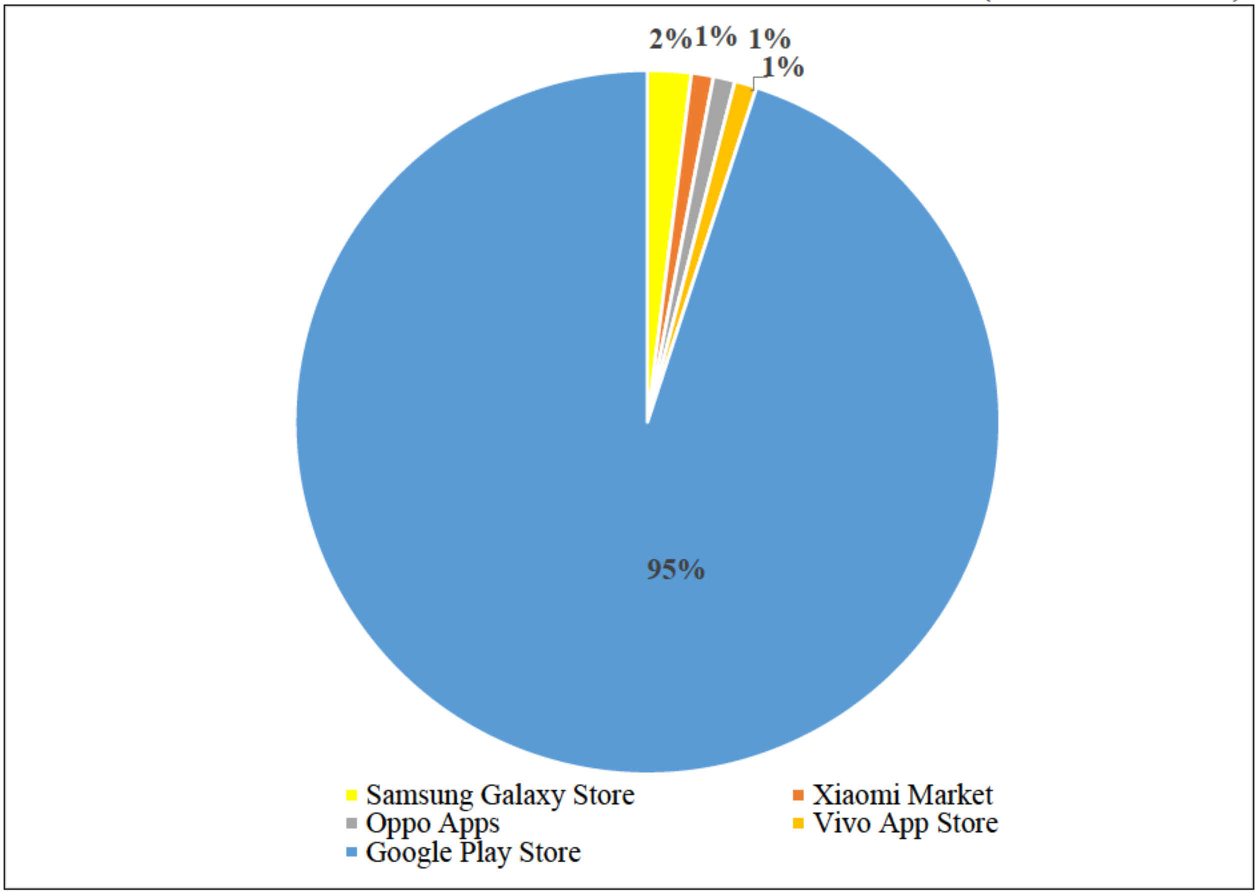


Source: GOOG-PLAY-002076224.R. Data as of October 2019.

126. The same document shows that the Play Store's market share is even higher when measured in terms of the amount of time that users spend in OEM App stores. As seen below, users spend 95 percent of their time in the Play Store, two percent in the Samsung Galaxy Store, and one percent or less in other OEM App stores. Even when these statistics are broken out by geographic area, "[f]or each region, the majority (>92%) of monthly [A]pp store time is spent in Play Store."[298]

298. GOOG-PLAY-002076224.R at -236.R.

FIGURE 9:
DISTRIBUTION OF TIME SPENT ON ANDROID OEM APP STORES WORLDWIDE (EXCLUDING CHINA)



Source: GOOG-PLAY-002076224.R. Data as of October 2019.

127. Internal Google data show that the Play Store accounts for the vast majority of App distribution on Google Android devices. As seen below, over [redacted] percent of App installations and updates on Google Android devices outside China are performed via the Play Store:

TABLE 1: GOOGLE PLAY SHARE OF APP INSTALLS AND UPDATES ON GOOGLE ANDROID DEVICES WITH GOOGLE PLAY PROTECT ENABLED, WORLDWIDE EXCLUDING CHINA (BILLIONS)

Month	[redacted]
Oct-20	
Nov-20	
Dec-20	
Jan-21	
Feb-21	
Mar-21	
Apr-21	
May-21	
Jun-21	
Jul-21	
Aug-21	
Sep-21	
Oct-21	
Nov-21	
Dec-21	
Jan-22	
Feb-22	
Mar-22	
Apr-22	
May-22	

Source: GOOG-PLAY-011142435.

128. The final two columns above encompass third-party App stores, OEM App stores, sideloaded Apps, and peer-to-peer ("P2P") file sharing protocols such as SHAREit, which Google's documents describe as [redacted] Although P2P file sharing can be used for legitimate purposes, the content shared may be pirated, and can expose users to significant risks such as "Cyber Attacks, Hacking Malware and Viruses Bandwidth Throttling and/or Monitoring by your ISP."[300]

129. Rival App stores such the Amazon Appstore account for [redacted] of the Android App Distribution Market. As shown below, from 2016 – 2020, the aggregate number of

299. GOOG-PLAY-000219435 at -9440 ("Unknown Sources: where are installs coming from?... [redacted]

300. Ryan McCarthy, *Is BitTorrent Safe?* DOWNLOAD PRIVACY (April 22, 2020), https://www.downloadprivacy.com/is-bittorrent-safe ("The most common dangers of using Bittorrent and downloading torrents can be broken down into a few categories. We will list them here and then explore them in more detail below. The risks of BitTorrent include: Cyber Attacks, Hacking Malware and Viruses Bandwidth Throttling and/or Monitoring by your ISP Legal Risk…"). *See also* Alicia Hope, "SHAREit Android File-Sharing App Security Flaw Exposes Users to Remote Code Execution and Sensitive Data Leaks," *CPO Magazine* (Feb. 22, 2021), https://www.cpomagazine.com/cyber-security/shareit-android-file-sharing-app-security-flaw-exposes-users-to-remote-code-execution-and-sensitive-data-leaks/; *see also* Kapersky Cybersecurity, *What Is BitTorrent and Is It Safe?*, https://www.kaspersky.com/resource-center/definitions/bittorrent ("Torrenting should be approached with caution. BitTorrent has a reputation as a technology used to pirate movies, games, and other copyrighted content. ISPs know this and often send warning letters and anti-piracy educational materials to BitTorrent users.").

initial downloads through the Amazon Appstore represented [redacted] percent to [redacted] percent of the volume of initial downloads on the Play Store:

TABLE 2: INITIAL DOWNLOADS, WORLDWIDE EXCLUDING CHINA (MILLIONS)

Year	Amazon Appstore	The Play Store	Amazon Appstore %
2016	[redacted]	98,182	0.2%
2017		120,827	0.2%
2018		130,114	0.2%
2019		136,440	0.1%
2020		171,496	0.1%

Sources: AMZ-GP_00001836, GOOG-PLAY-000808464.

130. The remaining App store rivals also have small shares of the Android App Distribution Market. As seen below, initial downloads through the [redacted] also represented only a small fraction (one percent or less) of initial downloads through the Play Store, as seen below. Other third-party App stores, such as [redacted] have market shares below one percent. In the aggregate, all third-party App stores combined account for less than five percent of initial downloads on Google Android devices worldwide excluding China, as seen below:

[redacted]

131. App store rivals lack many of the popular Apps available in the Play Store. For example, as seen below, eight of the ten most-downloaded Apps in the Play Store as of mid-2022

were not available on the Galaxy Store. Similarly, only eight of the top 20 most-downloaded Play Store Apps were also available in the Galaxy Store.

TABLE 3: MOST TOP PLAY STORE APPS NOT AVAILABLE IN GALAXY STORE

Play Store Download Rank	App Name	In Galaxy Store?
1	WhatsApp	No
2	Facebook	No
3	Facebook Messenger	No
4	Instagram	Yes
5	Garena Free Fire: Rampage	No
6	TikTok	Yes
7	Candy Crush Saga	No
8	Subway Surfers	No
9	Snapchat	No
10	Spotify	No
11	UC Browser	Yes
12	Facebook Lite	No
13	Twitter	Yes
14	My Talking Tom	No
15	SHAREit	Yes
16	Viber	Yes
17	Netflix	No
18	MX Player	Yes
19	Skype	Yes
20	Telegram	No

Sources: AndroidRank, *List of Android Most Popular Google Play Apps*, androidrank.org/android-most-popular-google-play-apps; Dan Price, *The 20 Most Popular Android Apps in the Google Play Store*, MAKEUSEOF (Jul. 23, 2022), https://www.makeuseof.com/tag/most-popular-android-apps/ ; Samsung Galaxy Store, https://galaxystore.samsung.com/. Excludes Google Apps preloaded on Android devices, such as Gmail and Google Maps.

132. Google's conduct vis-à-vis developers—including preventing developers from steering users to rival stores and conditioning developers' access to valuable advertising programs on YouTube and Google Search on the sale and distribution of developers' Apps in the Play Store—has substantially foreclosed potential opportunities for alternative App stores to compete with Google, effectively hindering their ability to develop into viable alternative distribution channels for developers. Absent these provisions, developers would have been more inclined to participate in and promote (via steering) alternative App stores, such as those owned by Amazon.

133. Samsung's Galaxy Store is preinstalled on all Samsung Android devices. However, Samsung's Galaxy Store has not provided effective competition for the Play Store As explained more fully in Part IV.A.2.c below, in part due to Google's conduct, the Galaxy Store has not gained

widespread traction with developers.[301] In addition, since the Galaxy Store appears only on Samsung devices, it is more limited in reach than the Play Store. This limited reach serves as a deterrent to some developers from investing in the Galaxy Store.[302]

134. The data also show that non-Galaxy App stores achieved only trivial penetration, as they have been pre-loaded on fewer than eleven percent of all Android devices. As seen below in Table 4, between 2018 and 2021, the Amazon store was on fewer than 1.5 percent of active Android devices, and the [redacted] store was on fewer than ten percent of active Android devices.[303]

TABLE 4: SHARE OF ACTIVE ANDROID DEVICES WITH ALTERNATIVE APP STORES

Year	Amazon	LG	Galaxy
2018	[redacted]	[redacted]	[redacted]
2019	[redacted]	[redacted]	[redacted]
2020	[redacted]	[redacted]	[redacted]
2021	[redacted]	[redacted]	[redacted]

Source: GOOG-PLAY-007203253.

135. With respect to entry barriers, as a two-sided platform, the Play Store benefits from indirect network effects, which serve to entrench its market power.[304] Apps attract users, which in turn attract developers, a virtuous cycle that rewards first movers and thwarts later potential entrants. Google recognizes the power that it gets from these network effects.[305] In addition, Google Android's significant share of the number of all mobile devices, [306] means that developers have strong incentives to make their apps Android-compatible to cover the fixed costs of App development. Thus, developers effectively must list their Apps on the Play Store and agree to its restrictive conditions, including the prohibition on steering users to rival App stores. These restrictions therefore act as substantial barriers to entry for effective competition from rival App stores.

136. The impact of indirect network effects in the Android App Distribution Market is reflected in these statistics: the Play Store offered 3.5 million Apps by the second quarter of 2022,[307] the most of any App store in the Android App Distribution Market. In comparison, the Amazon Appstore offered approximately 460,000 Android Apps.[308] Google recognizes the power

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301. *See, e.g.*, Daria Dubrova, *9 Alternative Android App Stores*, THE APP SOLUTIONS, theAppsolutions.com/blog/marketing/alternative-android-app-stores/ ("From the company that manufacturers the most Android phones it is no surprise that Samsung has developed their own App store. Compared to other App stores, Samsung Galaxy Apps has a relatively small number of Apps but this can be positive for Apps to stand out.").

302. Koh Dep. 323:3-23 [redacted] didn't invest in the Galaxy Store given its limited reach).

303. GOOG-PLAY-007203253.

304. *See generally* Jean-Charles Rochet & Jean Tirole, *Platform Competition in Two-Sided Markets*, 1(4) EUROPEAN ECONOMIC ASSOCIATION 990 (2003) [hereafter Rochet & Tirole].

305. GOOG-PLAY-000879194.R ("Amazon competitor deep dive" April 2017).

306. Statista, *Market share of mobile operating systems worldwide 2012-2022* (Aug. 30, 2022), statista.com/statistics/272698/global-market-share-held-by-mobile-operating-systems-since-2009/

307. *See* Statista, *Number of apps available in leading app stores as of 2nd quarter 2022*, statista.com/statistics/276623/number-of-Apps-available-in-leading-app-stores/.

308. *Id.*

of network effects in giving its store an advantage: "Play benefits from network effects. Users come to Play because we have by far the most compelling catalogue of Apps/games. Developers come to Play because that's where the users are."[309] Google also admits significant impediments to competition, noting that the process of sideloading the Amazon Appstore involves 14 steps, is "quite complex," and the hurdle is "too high for most users" to take advantage of any discounts offered by Amazon.[310] As one Amazon document explained, "Apple and Google's app stores came pre-installed on iPhones and Androids, respectively, while accessing Amazon's Appstore required sideloading via a web browser…Users needed to figure out how to allow downloads from unknown sources on their own."[311]

137. The entry barriers in the Market for Licensed Mobile Operating Systems, reviewed in Part I.C.2.a above, also serve as entry barriers in the Android App Distribution Market. For example, if a rival mobile operating system were to gain substantial market share, competitive App stores in the Android App Distribution Market could distribute their Apps through the rival OS.

b. High Profit Margins

138. According to Google's compilations of its profit-and-loss statement for the Play Store, excluding ads, Google earned an operating profit of [redacted] in 2019, a [redacted] over the Play Store's profit of [redacted] in 2018.[312] Google's operating profit from the Play Store, again excluding ads, [redacted] to [redacted] in 2020, an [redacted] of [redacted] from the prior year.[313] The Play Store's gross profit margin in 2020 was [redacted] and its operating profit margin was [redacted] A separate spreadsheet shows that, in 2020 alone, Google earned an *additional* [redacted] on ads that appear in the Play Store, with [redacted] of those revenues [redacted] In 2021, the Play Store's gross profit margin was [redacted] its operating profit margin was [redacted] and its operating profit was [redacted] In 2021, Google earned an *additional* [redacted] on ads that appear in the

309. GOOG-PLAY-000879194.R at -207.R.
310. *Id.* at -204.R.
311. AMZ-GP_00001672 at -1673 ("Apple and Google's app stores came pre-installed on iPhones and Androids, respectively, while accessing Amazon's Appstore required sideloading via a web browser. The Amazon Appstore download page gave clear instructions for the user to 1) "Turn on Unknown Sources" (within the Download Sources section of settings) and 2) "Install app" However, the picture under "Turn on Unknown Sources" did not match the settings for numerous Android phones we tested (LG K30, Galaxy S9, Samsung Galaxy S20, Pixel 3, ASUS Zenfone Max M2). Users needed to figure out how to allow downloads from unknown sources on their own.").
312. GOOG-PLAY-000416245.
313. *Id.*
314. *Id.*
315. GOOG-PLAY-001090227 (showing Play advertising revenue of [redacted] in 2020, with cost of sales of [redacted] direct operating expenses of [redacted] and cost allocations of [redacted] These data imply that, in 2020, Google earned a gross margin on Play Store advertising revenue of [redacted] Similarly, the 2020 operating margin inclusive of direct costs is [redacted] and the 2020 operating margin inclusive of direct costs and cost allocations is [redacted]
316. GOOG-PLAY-010801682 (showing 2021 Play Store revenue (excluding ads) of [redacted] and gross profit of [redacted] for gross profit margin of [redacted] The Play Store's operating profit was [redacted] in 2021, for an operating profit margin of [redacted] percent).

Play Store, with [redacted] of those revenues (again) [redacted] Google has projected that the Play Store's operating income will [redacted] to [redacted] by 2025.[318]

139. Even these figures are conservative because they do not reflect the Play Store's additional contributions to Google's core advertising business. Google uses the Play Store to collect and monetize valuable information on mobile users, just as it does with other components of the GMS suite such as Google Maps. Google has developed a device identifier known as the Android Advertising ID, to be used for "Advertising and Analytics purposes."[319] Starting in 2014, Google required developers to use the Android Advertising ID.[320] Google has integrated the Android Advertising ID into Google AdMob ("AdMob"), a mobile advertising subsidiary that Google markets to developers as a tool for "maximi[zing] your ad revenue."[321] According to Google, "[a]s one of the largest global ad networks, AdMob works with millions of advertisers to compete for your ad space[.]"[322] Google does not directly charge developers for Admob,[323] but instead takes a commission of approximately 30 percent of advertising revenue.[324] Admob is part of the Google Network, which generated $23 billion in revenue in 2020.[325]

III. GOOGLE'S MONOPOLY POWER IN THE IN-APP AFTERMARKET

140. In this section, I demonstrate that the In-App Aftermarket, defined as the aftermarket for services in support of consummating purchases of In-App Content on Android devices, is a distinct relevant antitrust market. I also demonstrate that Google has monopoly power in this market.

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317. GOOG-PLAY-010801680 (showing Play Store advertising revenue of [redacted] in 2021, with a gross profit of [redacted] for a gross profit [redacted] Total operating expenses (inclusive of direct costs and cost allocations) are recorded at [redacted] yielding an operating profit of [redacted] for an operating margin of [redacted]

318. GOOG-PLAY-010371364 at -376.

319. GOOG-PLAY-006418378.R, at 8379.R *See also* John Koetsie, "Mobile Tutorial Series – What is a Google advertising ID or GAID?" (September 22, 2020), : https://www.singular net/blog/google-advertising-id-gaid/ ("The Google advertising ID is a device identifier for advertisers that allows them to anonymously track user ad activity on Android devices")

320. GOOG-PLAY-000891892 at -896 ("Beginning August 1st 2014, all updates and new Apps uploaded to the Play Store must use the advertising ID (when available on a device) in lieu of any other device identifiers for any advertising purposes.").

321. *See* Google AdMob, *Discover the AdMob advantage*, admob.google.com/home/admob-advantage/.

322. *Id. See also* Google AdMob, admob.google.com/home/.

323. *See* Google AdMob, *Discover the AdMob advantage*, admob.google.com/home/admob-advantage/.

324. Paresh Dave, *Google's App network quietly becomes huge growth engine*, REUTERS (Feb. 15, 2018), reuters.com/article/us-alphabet-admob/googles-app-network-quietly-becomes-huge-growth-engine-idUSKCN1FZ0F9 ("[A]s consumers migrate from desktop computing to mobile, momentum has shifted to Admob, Google's mass-market tool for third-party Apps, and DoubleClick for Publishers, its higher-end mobile software…Google gives developers about 70 cents of every $1 it collects from ad buyers.")

325. *See, e.g.*, Megan Graham & Jenifer Elias, *How Google's $150 billion advertising business works*, CNBC (May 18, 2021), cnbc.com/2021/05/18/how-does-google-make-money-advertising-business-breakdown-.html ("The third main component of Google's advertising revenue is the Google Network, which at $23 billion in 2020 made up about 16% of its total ad revenues. This bucket includes revenue generated from selling ads outside of Google's own properties. Generally speaking, publishers or App makers can use Google platforms such as AdSense, Google Ad Manager, or AdMob to offer ad slots up for sale to advertisers. Publishers use these tools to manage their campaigns, while turning some inventory over to Google to match with advertisers. The publishers and Google split the revenue in various proportions depending on how much work each party is doing.")

A. The In-App Aftermarket Is a Distinct Relevant Antitrust Market

141. After a consumer has examined the available options on the Play Store, selected an App, and downloaded it to her device, the developer may choose to offer In-App Content for purchase and download. Such content can include, among others, access to an ad-free version of the App; videos or interactive programs that run within the App; or avatars, tokens, or other accessories used for in-App gameplay. When Apps are free, the sale of In-App Content is often a major way for developers to earn revenue. Indeed, record evidence suggests that the revenues developers receive for In-App Content vastly exceed the revenues developers receive for initial download of Apps.[326]

142. To provide In-App Content, developers must be able to authorize consumers to use such content and consumers must be able to pay for it. Payment systems require software that securely verifies and accepts customer purchases and may perform other related functions such as storing information about users and their purchasing history or tracking payment histories. Payment systems are also keyed to trigger the unlocking and authorization for the delivery of In-App Content once it is purchased and paid for by consumers. That is, distribution of In-App Content is not complete until the consumer can use those items, and that does not occur until payment is processed and the feature is unlocked.[327]

143. The Play Store is not needed in these In-App Aftermarket services, as the matchmaking function is not present. Thus, the one-sided In-App Aftermarket is distinct from the two-sided Android App Distribution Market. *See* Part III.A, *supra.* Lawrence Koh, former Global Head of Games Business Development at Google, testified that, in the delivery of In-App Content to consumers, in-App item inventory resides on developers' (not Google's) servers.[328] Although the consumer pays Google directly, and (by virtue of the billing system tie-in) Google provides confirmation of payment, it is the developer, not Google, that releases and delivers In-App Content to the consumer.[329] I also understand that Professor Schmidt finds that, as a technological matter, there is no basis for Google to insert itself into the In-App Aftermarket by requiring that developers use Google Play Billing.

1. The In-App Aftermarket Is One-Sided

144. When it comes to the purchase of In-App Content, the customer and the developer have already found each other. The derived demand for services in support of the purchase of In-App Content in the In-App Aftermarket thus lacks any indirect network efforts: adding more consumers or developers does not add value to the relationship between a developer-customer pair or the associated services in support of consummating in-App transactions. Matchmaking services, critically present in the Android App Distribution Market, are not present in the In-App Aftermarket. And the Android App Distribution Market does not provide services sufficient to complete the delivery of In-App Content to the consumer. The In-App Aftermarket is therefore economically distinct from the two-sided platform market contemplated in *Ohio v. American Express* ("*Amex*"), in which the Supreme Court emphasized the determinative role of "indirect

326. GOOG-PLAY-000379093.
327. I understand that Professor Schmidt's findings support this conclusion.
328. Koh Dep. 381:4-382:6.
329. *Id*. at 383:3-21.

network effects,"[330] which "exist where the value of the two-sided platform to one group of participants depends on how many members of a different group participate."[331] According to the Supreme Court, when "the indirect network effects operate in only one direction," the market "behaves much like a one-sided market and should be analyzed as such."[332]

2. There is Separate Demand for In-App Aftermarket services

145. Record evidence confirms that there is separate demand for In-App Aftermarket services.[333] In 2011, around the time that Google first introduced its own payments system for the purchase of In-App Content, Google employees discussed "how we will 'transition' apps using other in-app payments systems to our IAB service."[334] A 2021 Google slide deck displays numerous potential competitors in the In-App Aftermarket, including Facebook, Amazon, Epic, Samsung, and Stripe.[335] According to this document, potential competitors could be advantageous for developers due to factors such as "simplicity and ease of integration," and "cost optimization."[336] Thus, Google recognizes that Google Play Billing is a separate product with separate demand, with the potential for substantial competition in the absence of the Aftermarket Tie-In. As of 2019, various well-known Apps had not adopted Google Play Billing, including Hulu, Kindle, Netflix, Tinder, and Google's YouTube App.[337] When Tinder stopped using Google Play Billing in 2019, Google received "new inquiries from developers" about alternatives to Google Play Billing, including from major Apps such as Dropbox.[338]

146. Netflix's refusal to use Google Play Billing also demonstrates the existence of separate demand. Although Netflix is distributed through the Play Store, Netflix has declined to use Google Play Billing, in light of concerns that Google Play Billing is less efficient than Netflix's own billing systems.[339] Internal Netflix documents indicate there were "numerous arguments for

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330. *Ohio v. American Express Co.*, 138 S.Ct. 2274, 2280 (2018).

331. *Id.*

332. *Id.* at 12-13 ("To be sure, it is not always necessary to consider both sides of a two-sided platform. A market should be treated as one-sided when the impacts of indirect network effects and relative pricing in that market are minor. Newspapers that sell advertisements, for example, arguably operate a two-sided platform because the value of an advertisement increases as more people read the newspaper. But in the newspaper-advertisement market, the indirect network effects operate in only one direction; newspaper readers are largely indifferent to the amount of advertising that a newspaper contains. Because of these weak indirect network effects, the market for newspaper advertising behaves much like a one-sided market and should be analyzed as such.") (citations omitted).

333. *See, e.g.,* GOOG-PLAY-000260305 (in a developer conference in Tel Aviv in January 2020, a Google employee met with a "bunch of App developers" that "were quite vocal" and "asked for permission to offer off-play billing options for their users 'just like some big name Apps on Play are currently doing'"). *See also* GOOG-PLAY-002440706 (Explaining that [redacted] (emphasis in original)).

334. GOOG-PLAY-004320094.

335. GOOG-PLAY-006829073.R at -159.R. *See also Id.* at -153.R (Google slide deck illustrating "[h]ow payment providers and aggregators could ladder up on mobile.")

336. *Id.* at -097.R, -103.R.

337. GOOG-PLAY-003334312 at -314.

338. *Id.* at -323, -347.

339. NETFLIX-GOOGLE-00000022 at -27 ("We don't see a scenario where Google's payment system would outperform, or even match our own […] Given most recent test results, any different economic model is not feasible, as it would still result in a negative revenue impact to Netflix"). *See also* Ron Amadeo, *Google announces crackdown*

why [Netflix] should move away from Google Play Billing" when Google indicated it would ramp up enforcement of the Aftermarket Tie-In.[340] Netflix cited various deficiencies in Google Play Billing—such as a lack of sophistication in handling recurring payments, poor methods of payment, customer support issues, loss of control in the user cancellation flow, mode of payment transition frictions, and lack of flexibility in price changes.[341] Netflix conducted studies on the value of Google Play Billing compared to using its own payment systems. A May 2018 quasi-experimental analysis found that "Play Store signups are significantly less engaged . . . than browser sign ups in every country" and that "[i]t is unlikely that offering Play Store signups will become a net positive for Netflix."[342] A July 2018 PP&A Analysis concluded that there were "no regions where [Netflix] think[s] a partner's payment is better" than Netflix payments systems, and that Google would have to offer Netflix a 9% revenue share to make Netflix indifferent between using or not using Google Play Billing.[343] A July 2018 Netflix slide deck provides results of both a 2016-2017 A/B Test of billing systems, as well as the quasi-experimental analysis conducted earlier that year, and found that "GPB [Google Play Billing] underperforms relative to Netflix" and that there was "[m]uch lower retention on GPB[.]"[344]

147. In 2019, the developer Magic Lab was "us[ing] Google Play Billing alongside its own billing infrastructure [redacted] Similar to [redacted] Record evidence indicates that [redacted] Magic Lab attributed the decline in part to a "non-existent one click buy and UX/UI that leaves users unaware of payment options."[348]

148. The developer Match.com has indicated to Google that being required to use Google Play Billing would have a significant negative impact on its customers.[349] Match found [redacted]

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on in-App billing, aimed at Netflix and Spotify, ARSTECHNICA (Sep. 29, 2020), arstechnica.com/gadgets/2020/09/google-announces-crackdown-on-in-app-billing-aimed-at-netflix-and-spotify/ ("Today, Netflix and Spotify don't use Google's in-App billing and instead kick new accounts out to a Web browser, where the companies can use PayPal or direct credit card processing to dodge Google's 30-percent fees.").

340. NETFLIX-GOOGLE-00000002 (Google's policy change required that "App makers now must use Google exclusively for all digital content purchases within an App and pay Google a recurring transaction fee. If the App maker chooses not to use Google Billing, the App can only offer a consumption experience - removing all aspects of commerce (sign-up, upgrade, change payment, etc).").

341. *Id.* at -02-05.

342. NETFLIX-GOOGLE-00000030. *See also* NETFLIX-GOOGLE-00000029 (spreadsheet of underlying data).

343. NETFLIX-GOOGLE-00000015 at -15-17.

344. NETFLIX-GOOGLE-00000022 at -23. *See also* NETFLIX-GOOGLE-00000019 (spreadsheet of underlying data).

345.GOOG-PLAY-011274411.

346. *Id.*

347. *Id.*

348. GOOG-PLAY-011380975 at -976—977.

349.GOOG-PLAY-011275555.

[redacted]"[350] Match.com estimated that [redacted][351]

149. Google's announcement requiring the exclusive use of GPB for purchases of digital goods and services, includes a set of FAQs and proposed responses that recognize the limitations of GPB.[352] One of the anticipated questions was that developers would inquire about features that are supported on only the developer's "own platform", which could negatively impact revenue.[353] Google also anticipated that developers would reference "experiments with GPB" indicating that GPB "underperformed," such that the developer would want to continue to offer multiple payment options to its customers.[354] However, the only option for developers in this position would be to leave Play or proceed as a "consumption-only" App (that is, to cease offering in-App purchases) which Google recognized to be a "suboptimal experience [that] does not allow you the opportunity to monetize on Android."[355]

150. Moreover, I understand that Professor Schmidt finds that, as a technological matter, there is no basis for Google to insert itself into the In-App Aftermarket by requiring Google Play Billing be used when consumers purchase In-App Content on Play-distributed apps. Google's forced insertion into the In-App Aftermarket is properly analyzed as an anticompetitive extension of the power it possesses in the separate and distinct Android App Distribution Market. My analysis first examines these two relevant markets, and my models of impact are aimed at these markets separately, with a few caveats. To model the scenario where rival App stores compete on the dimension of a consumer subsidy (rather than on take rates), I treat the two markets as a single market, under the assumption that any enhanced consumer discounts could be used by consumers for both paid initial downloads and the purchase of In-App Content. I also offer a model in which rival App stores compete on the take rate assuming (in the alternative) the two markets are a single market.

3. Standard SSNIP Test Demonstrates the In-App Aftermarket Is a Relevant Antitrust Market

151. A standard SSNIP test confirms that the In-App Aftermarket is a relevant antitrust product market:

- In a more competitive but-for world, the take rate in the In-App Aftermarket would be approximately 14.4 percent. (*See* Table 8, *infra*).

- A hypothetical five percent increase above competitive levels would increase the take rate to approximately 15.1 percent (equal to 0.144 x [1.05]), which is far below Google's 30 percent headline take rate.

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350. *Id*. at -558.
351. *Id*. at -559.
352.GOOG-PLAY-011394225.
353. *Id*. at -228.
354. *Id*. at -230—231.
355. *Id* at -231—232 (explaining that as a consumption only app, the developer cannot link users to mobile web to complete the transaction from within the app, nor could it direct the users via in-App text to the developer's website to explain where they can subscribe).

- Therefore, Google could (and did) profitably maintain the take rate in the In-App Aftermarket far above competitive levels for the duration of the Class Period.

- Consequently, a (not-so) hypothetical monopolist could profitably impose a SSNIP on the price charged to developers in the In-App Aftermarket.

152. Google uses its contracts with developers to control the In-App Aftermarket. Initially, Google requires that, if an App is offered through the Play Store, the developer must use Google Play Billing for all consumer purchases of In-App Content.[356] Google utilizes Google Play Billing to impose a general take rate of 30 percent (with the aforementioned exceptions)—the same take rate it commands in the Android App Distribution Market—on all such purchases in perpetuity.[357]

153. Absent Google's restrictions, competition would materialize and there would be alternative providers of In-App Aftermarket services, including authorization and payment systems. And record evidence shows that developers seek those services from third parties,[358] consistent with the notion of a *demand separate* from the matchmaking service offered via the App store in the Android App Distribution Market. The developer's demand for those services is derived from the consumer's demand for In-App Content. That numerous major developers have gone through the effort to use other systems, and to steer users to those systems (see Part V.B below), provides economic evidence that there is market demand for the In-App Aftermarket services separate from the matchmaking services provided in the Android App Distribution Market.[359] Potential competitors include the major payment systems now used for online Internet

356. Google Developer Program Policy (effective Dec. 1, 2021), support.google.com/googleplay/android-developer/answer/11498144?hl=en&visit_id=637814760589469507-2803788482&rd=1. *See also* my discussion earlier in Part V.A.

357. *See* Google Play, *Google Play has something for everyone,* play.google.com/about/howplayworks/?section=about-google-play&content=service-fee. The service fee applies if developers "sell subscriptions or other digital content within an app," but is not affected by the length of time after an App is downloaded – with the exception of subscription products, which face a lower service fee after being retained for over a year. *See* Play Console Help, *Service fees*, support.google.com/googleplay/android-developer/answer/112622?hl=en.

358. *See, e.g.,* Koh Dep. 183:14-18 ("There were developers that aspired to be -- have owned the end-to-end cycle. And yes, working with Google Play wouldn't allow developers to – developers aspired to own that, to own that, complete end to end."); Kevin Wang Dep. 94:14-21 (recalling that some developers were not interested in using Google's billing system). *See also* GOOG-PLAY-000259276 [redacted] is definitely not the only developer who would like to use their own payments system. There are only a handful who can build out a global system like ours, but that's not the only reason you'd want to use your own."); GOOG-PLAY-004703579 at -584 (Googlers knew Epic and [redacted] wanted to use their own billing, and suspected [redacted] would want to as well); GOOG-PLAY-004716632 ("[redacted])"); GOOG-PLAY-004721177 ("Audio partners who are negotiating… are asking for carve outs to the Play Billing exclusivity requirement…"); GOOG-PLAY-006817773.R at -802.R (Google kept track of developers' many issues with Google Play Billing exclusivity).

359. Although Google may have alleged security justifications for approving distribution methods of In-App Content, this can easily and less restrictively be accomplished by white-listing developers, a process that Google already conducts for OEMs, and by providing developers with certificates approving their security so that developers can use them with other payment processors.

purchases, such as credit and debit card networks, PayPal, distribution and payment systems used by other App stores, or developers themselves. I understand that Professor Schmidt finds that the software required for in-app purchases is already widely accessible and used for many online transactions and could readily be adapted to facilitate the purchase of In-App Content. Google froze out competitors by requiring that all developers use Google Play Billing, Google's own provider of services for the fulfillment and consummation of transactions for all In-App Content purchased in Apps that were downloaded from the Play Store. Notably, in discussions with PayPal, Google considered a scenario in which PayPal could directly unlock and distribute In-App Content without Google Play Billing.[360] Google has already used PayPal for some payment processing,[361] as do major mobile applications such as Airbnb, Skype, Netflix, and thousands of others.[362]

154. Google's prohibition of developer steering of consumers to outside authorization and payment channels indicates that third-party providers could replicate Google's authorization and payment channel for In-App Content and that there is a separate demand for those services.[363] Google's documents also recognize that developers sometimes demand, and utilize, alternative methods to accept payment for purchases of In-App Content.[364] Netflix, as one example, "views billing as a competitive advantage."[365]

155. Multiple internal analyses conducted by Google evidence that it considered Google Play Billing as a separate product it could offer in competition with other providers. One 2019 presentation contemplates that Google could "allow 3rd party payments" and "GPB begins to compete on price/services for business across digital and non-digital.[366] Likewise, a 2021 Google

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360. GOOG-PLAY-005653612.R at -617.R ("Billing Integration for Android Market.").

361. Feng Dep. 522:12-19 ("Q. Can you give us examples of the payment processors who would handle the transaction after it is relayed to them by Google? A. I think some examples would be Paymentech, Worldpay, Adyen, PayPal. There is a variety of different types that we use.").

362. *See* PayPal, "An app for the everyday," https://www.paypal.com/tc/webapps/mpp/shop/apps ("We're integrated into thousands of iOS and Android apps. Use our apps to shop on the go, make your travel reservations, or make payments abroad.")

363. *See* Google Play Payments Policy §4, https://support.google.com/googleplay/android-developer/answer/9858738?visit_id=637994598201252840-4239604614&rd=1 ("Other than the conditions described in Section 3 and Section 8, apps may not lead users to a payment method other than Google Play's billing system. This prohibition includes, but is not limited to, leading users to other payment methods via: • An app's listing in Google Play; • In-app promotions related to purchasable content; • In-app webviews, buttons, links, messaging, advertisements or other calls to action; and • In-app user interface flows, including account creation or sign-up flows, that lead users from an app to a payment method other than Google Play's billing system as part of those flows.")

364. Various developers have indicated a desire to use their own transaction services, declining the use Google Play Billing. [redacted] Match, [redacted] and others have invested in their own platforms and have expressed a desire to use a product other than Google's. See, e.g., GOOG-PLAY-000258923 at -924 [redacted] does not believe there's a path forward on GPB at any rational terms given 1) the higher observed churn on our platform and 2) the strategic importance they place on payments."); GOOG-PLAY-000840773 at -774 ("The larger (most profitable) services like match, [redacted] began as web businesses … and are actually quite sophisticated in terms of churn-reduction, reengagement, and buyer conversion. In some ways our billing platform is not as good as theirs currently are"); GOOG-PLAY-003334312 at -316 (noting developers have said "We want to give users choice of payment" and "my billing platform is a competitive advantage and would perform better for me"); GOOG-PLAY-004470512 at -513 ([redacted].

365. GOOG-PLAY-000259276 at -277.

366. GOOG-PLAY-000542516.R at -532.R (noting that GPB could provide "a native, secure payment solution for physical goods" as well as digital goods).

analysis titled "GPB as Platform of Choice" highlighted the ways Google could differentiate its offerings in the In-App Aftermarket such that Google could "elevate the product."[367] Google's internal analyses of competition among Google Play Billing and alternatives demonstrate separate demand for these services. These competitive analyses further demonstrate that distinct services are offered in the In-App Aftermarket as compared to the Android App Distribution Market.

156. Further, Google's documents recognize the possibility that payment systems for In-App Content could turn into full-blown competitive App stores. A Google document noted that "preventing payment circumvention" for In-App Content could reduce the possibility that a nascent competitor in the In-App Aftermarket would expand to be a full-bore App store competitor in the adjacent Android App Distribution Market.[368]

157. Google's efforts to prevent selected developers from circumventing Google Play Billing and using alternative means of authorization and payment processing for In-App Content is yet additional evidence that there are actual or potential competitors to Google's services for these items, and thus that there is a separate and distinct In-App Aftermarket. Google's documents also provide evidence that, without its contractual restrictions, Google's take rate for In-App Content would fall. For example, Google modeled the downward pressure on its take rate if it were to allow selected developers to use lower-cost alternative means of payment processing and to steer users to those alternatives.[369] This exercise demonstrates that Google recognized that authorization and payment processing for In-App Content is distinct from what it provides through the Play Store.

B. The Relevant Geographic In-App Aftermarket Is Global (Excluding China)

158. The geographic market for the In-App Aftermarket is also global (excluding China). If Google's restrictions were not in place, it would not require any increase in Google's current take rates to attract entrants from other countries into the In-App Aftermarket. One such provider, Coda Payments, is already active in Asia, and in fact approached Epic to provide its In-App Aftermarket services.[370] Thus, the geographic In-App Aftermarket is not limited solely to the United States but is worldwide (excluding China).

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367. GOOG-PLAY-007745829 (further noting that "As Developers are coming onto GPB (post payments policy), some are noticing that GPB doesn't compare to previous solutions in performance A/B tests.").

368. GOOG-PLAY-004564758. Google expressed concern that competitive "[payment] services aggressively push at the boundaries of the Play policy. The most overt example of this is Amazon's push into App distribution, but it is now more commonly seen in the sale of virtual, cross-App currencies or in-App items through web or offline channels. The challenges that these services pose to Google Play is proportional to the degree to which any of these services establishes themselves in any given market." *Id.* at -761. One of the "vectors of concern" was "payment disintermediation." *Id.* This is a similar anticompetitive theory of harm as that pursued by the Department of Justice (DOJ) in the *Microsoft* antitrust litigation, in which the dominant operating system tied its browser to its operating system with the alleged aim of preventing a rival browser from evolving into a full-bore competitor for Microsoft's operating system (or what the DOJ called "middleware"). *See U.S. v. Microsoft*, 253 F.3d 34 (D.C. Cir. 2001).

369. GOOG-PLAY-006829073 (Project Basecamp – Optionality).

370. EPIC_GOOGLE_00108372 [redacted] Other international in-App payment processors include Judopay (www.judopay.com/about), Paysafe (www.paysafe.com/us-en/), and Adyen (www.adyen.com/about)). *See also* GOOG-PLAY-006829073.R at -152.R-153.R [redacted].

C. Google's Market Power in the In-App Aftermarket

159. As with the Android App Distribution Market, I assess Google's power in the In-App Aftermarket through direct proof of firm-specific measures that speak directly to a firm's ability to profitably raise prices.[371] In Part VI.C below, I show that Google would be forced to reduce its take rate in the In-App Aftermarket absent its restraints, which is also direct evidence of its market power. That Google is able to impose restrictions on developers that exclude competition also evidences Google's power. I also examine indirect evidence—market shares and entry barriers—to establish that Google has market power in the In-App Aftermarket.

1. Direct Evidence: Ability to Exclude Rivals and Charge Supracompetitive Prices

160. Through the Aftermarket Tie-In, Google has excluded nearly all rivals from the In-App Aftermarket. As of September 2020, only about three percent of developers in the Play Store were using payment processors other than Google Play Billing for purchases of In-App Content; at this time, Google gave this remaining three percent one year to drop these In-App Aftermarket rivals in favor of Google Play Billing.[372]

161. Google's foreclosure of Epic from the In-App Aftermarket illustrates its monopoly power. Google removed the Fortnite App from the Play Store after Epic introduced its own payment system on Android, offering users discounts of up to 20 percent on purchases of Fortnite's in-game currency (which is used for purchasing In-App Content) if they chose to use Epic's payment system instead of Google Play Billing.[373]

162. Google's 30 percent standard take rate for initial downloads and purchases of In-App Content is direct evidence of its market power in the In-App Aftermarket. In the Android App Distribution Market, the Play Store brings together consumers and developers in a matchmaking

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371. Herbert Hovenkamp, *Digital Cluster Markets*, 1 COLUMBIA BUSINESS LAW REVIEW 246, 272 (2022). ("By contrast, 'direct' proof relies on estimates of firm elasticity of demand, evidenced mainly by a firm's price-cost margins or output responses to price changes.[] These methodologies are capable of giving more accurate measures of market power as it is best defined—the ability of a firm to profit by raising its price above its costs.[]") citing 2B Phillip E. Areeda & Hebert Hovenkamp, ANTITRUST LAW ¶521 (5th ed. 2021) (forthcoming); Louis Kaplow, *Why (Ever) Define Markets?,* 124 HARVARD LAW REVIEW 437 (2010).

372. *See* Sameer Samat, *Listening to Developer Feedback to Improve Google Play*, ANDROID DEVELOPERS BLOG (Sept. 28, 2020), android-developers.googleblog.com/2020/09/listening-to-developer-feedback-to.html. ("Less than 3% of developers with apps on Play sold digital goods over the last 12 months, and of this 3%, the vast majority (nearly 97%) already use Google Play's billing."). Google later announced that, although many of the holdouts "have been making steady progress" toward compliance with the In-App Aftermarket Tie-In, it would grant an extension to its original compliance deadline. *See* Purnima Kochikar, *Allowing developers to apply for more time to comply with Play Payments Policy*, ANDROID DEVELOPERS BLOG (Jul. 16, 2021), android-developers.googleblog.com/2021/07/apply-more-time-play-payments-policy.html. This extension was granted after Google was sued by 36 state attorneys general over the In-App Aftermarket Tie-In and other practices. *See* Tim De Chant, *Google "bought off Samsung" to limit app store competition, 36 states allege*, ARS TECHNICA (Jul. 8, 2021), arstechnica netblogpro.com/tech-policy/2021/07/google-bought-off-samsung-to-limit-app-store-competition-36-states-allege/.

373. Amanda Yeo, *'Fortnite' has now been punted from the Google Play Store as well*, MASHABLE (Aug. 13, 2020), mashable.com/article/fortnite-android-google-play-store. *See also* Todd Haselton, *Fortnite maker challeneges Apple and Google's app store rules through direct-payment discounts*, CNBC (Aug. 13, 2020), cnbc.com/2020/08/13/fortnite-discount-appears-to-break-apple-google-app-store-rules html.

role, though in many cases the consumer would be aware of the App she sought before searching for it in the Play Store, suggesting a more modest contribution by Google to value added.[374] In contrast, there is no matchmaking role in the purchase of In-App Content or for the services in support of consummating those purchases in the In-App Aftermarket.

163. Because Google as an intermediary provides additional value in the Android App Distribution Market via matchmaking, one would expect that, as in competitive markets where the take rate reflects the value added by the intermediary, the take rate in the Android App Distribution Market would exceed any take rate in the In-App Aftermarket. That Google's take rate—a price that presumably reflects its value-added to the transaction—is the same for initial downloads and purchases of In-App Content made even five years later strongly suggests that Google has anticompetitively extended its market power from the Android App Distribution Market into the In-App Aftermarket.

164. Indeed, a Google document shows that its elevation of take rates over competitive levels is substantially profitable, suggesting that Google possesses market power. In a 2020 business strategy document recommending reductions in the take rate to 15 percent one year after download (in other words, in the In-App Aftermarket), Google conceded "[t]here is a lot of external and internal pressure on our GPB [Google Play Billing] business model,"[375] suggesting that Google's artificial insertion of its billing system into the In-App Aftermarket at a 30 percent take rate was drawing ire from developers.[376] Google estimated that reducing the take rate to 15 percent after one year would reduce its revenues by roughly [redacted] implying that imposing the current 30 percent take rate rather than 15 percent increases its profit for one year [redacted]

165. Google's ability to price discriminate also evidences its market power. Basic economic principles tell us that "[f]or a firm to price discriminate, it must have some market power."[378] In a document titled "Project Secret Carrots," Google recognized that its 30 percent take rate did not work for all developers, including media and streaming Apps.[379] Google even noted that its 30 percent take rate was "untenable" for certain Apps.[380] Google implemented programs for other developers such as the "Living Room Accelerator Program" ("LRAP") which

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374. Google's documents provide evidence that the majority of downloads from the Play Store are the result of users that "already know the App prior to the Store visit." GOOG-PLAY-007317574 at -585. A 2020 survey found that [redacted] are from explicit visits to install the app," while [redacted] are implicit from user browsing behavior." *Id.* at -578. Similarly, when asked whether they knew about an acquired App before visiting the Play Store, [redacted] responded affirmatively. *Id.* at -584. [redacted] thought that information provided by the Play Store about an App (e.g., screen shots, number of downloads) was useful in making the initial installation decision. *Id.* at -591.

375. GOOG-PLAY-006990552 at -553.

376. *Id.* ("We recommend changing to a 30/15 service fee for (year 1 / subsequent) with the optional addition of a distribution services revenue stream which will compensate for some kind of lost revenue and improve diversity but will also incite frustration in the set of developers who had previously paid nothing.").

377. *Id.* ("30/15 after year 1 will cost [redacted]

378. N. GREGORY MANKIW, PRINCIPLES OF MICROECONOMICS 303-304 (Cengage Learning 8th ed. 2018) [hereafter MANKIW] ("price discrimination is not possible when a good is sold in a competitive market"; "For a firm to price discriminate, it must have some market power.").

379. GOOG-PLAY-007329063.

380. *Id.* at -066.

lowered the take rate for Apps that delivered media-related In-App Content to users,[381] offering some developers a 15 percent take rate.[382] LRAP required developers to distribute through the Play Store to all Android TV devices and use Google Play Billing as the sole payment method for subscription billing in return for a 15 percent take rate.[383] The "Apps Velocity Program" ("AVP") provided incentives (such as credits towards ads and cloud usage, Play Point participation, and co-marketing agreements), in exchange for developer integration into the Android ecosystem and agreements to use Google Play Billing as the sole method of payment.[384]

166. The "Subscribe with Google" ("SwG") program was designed to increase news publisher integration with Android, providing them with a 15% take rate for sales through the Play Store and 5% for those accessed on the web, along with various funding and promotional agreements with different partners.[385] Likewise, the "Audio Distribution Accelerator Program" ("ADAP") was geared towards integrating digital music and audio content Apps with Android,

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381. *See* Defendants' Answers and Objections to Developer Plaintiffs' First Set of Interrogatories to Defendants (July 6, 2021) at 13-16. *See also* Google Play Console, *Play Media Experience Program*, play.google.com/console/about/mediaprogram/.

382. GOOG-PLAY-000259276 at -277 ("Conversations are ongoing regarding [redacted] enabling Google Play Billing for in-App purchases on a subset of Android TV OEMs…Exact economics still need to be figured out but could be close to LRAP's (~15%)").

383. LRAP Requirements include: (a) Distribution: "Relevant Product must be distributed through the Store to all Android TV"; (b) In-App Billing: "Relevant Product must use the Store's in-App billing […] as the sole payment method offered in the Relevant Product for subscription billing across Devices and all markets in which the Relevant Product is available on the Store"; (c) Android TV Feature Integration: "Relevant Product must integrate the Android TV"; (d) Android UX Requirements: "Relevant Product must meet Android's design guidelines"; (e) Google Cast Receiver Integration: "Relevant Product must be Cast-Certified"; (f) Content Parity: "Relevant product must have the same content as the same or similar applications or services made available by Developer on other, non-Android platforms"; (g) Feature Parity: "Developer must use good faith efforts to ensure that Relevant Product has the same features as the same or similar applications or services made available by Developer on other, non-Android platforms"; (h) Pricing Parity: "Relevant Product must not be priced higher than the same or similar applications or services made available by Developer on other, non-Android platforms"; (i) Marketing: "Developer will announce and promote the Relevant Product's availability on the Store." GOOG-PLAY-007271978 at 78-79. Generally, the LRAP agreement was a 5–9-page agreement based on the requirements discussed, such as those agreements signed by [redacted] etc. Other partners, such as [redacted] signed more detailed agreements with additional clauses. *See, e.g.,* GOOG-PLAY-007271978 [redacted] GOOG-PLAY-007272461 [redacted] GOOG-PLAY-007317231 [redacted] GOOG-PLAY-007317239 [redacted] GOOG-PLAY-009214128 [redacted]

384. GOOG-PLAY-009214167 (Apps Velocity Program Addendum for [redacted] Developer obligations include (1) Parity requirements, including content and feature parity, SKU parity, and pricing parity; (2) Google Play Billing as the sole payment method, with integration of the Google Play Billing Library, Google Play Billing APIs, ad Real Time Developer Notifications; (3) Within 6 months of Play Billing certification, the developer must integrate Android compatibility, the Android App bundle publishing format, dynamic features modules for Play feature delivery, tablet optimization, foldable device optimization, Wear OS optimization, a signed Trusted Tester Agreement, quality design maintenance, technical design maintenance, non-removal of any of the titles, and a minimum 4.0 user rating using "commercially reasonable" efforts. The developer also must earn a certain amount on Play or pay Google a "deficiency amount." *Id. See also, e.g.,* GOOG-PLAY-007505091 (Apps Velocity Program Addendum for the [redacted]

385. GOOG-PLAY-007335282 (Subscribe with Google Agreement with [redacted] Eligibility for the program included (1) having a Newsstand Agreement; (2) have a Developer Account with Google Play; (3) Integrating the implementation requirements; (4) charging no more for content through Subscribe with Google than through other channels; and (5) complying with the Google API Terms of Service. *Id.* at -82-83. Entities such as the [redacted] and [redacted] were provided with further promotional addendums. *See, e.g.,* GOOG-PLAY-007272709 and GOOG-PLAY-007272817. Some partners received funding towards specific projects, such as [redacted] GOOG-PLAY-007273682.

and provided a [redacted] take rate for subscription purchases.[386] Google's ability to target specific price breaks and benefits to different customer types through these various programs attests to its market power.

167. [redacted]

168. Record evidence indicates that Google offered a few select developers even lower take rates. According to one document, [redacted] is only one of a select group of developers that have been offered a [redacted] rev share."[389] A [redacted] executive testified that Google and [redacted] have reached a user-choice billing agreement in which the take rate is [redacted] when the user chooses not to use Google Play Billing, and approximately [redacted] otherwise.[390] The same witness testified that Google has "published rates" showing a [redacted] take rate for "a media

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386. ADAP required that developers (1) integrate with the latest version of Android; (2) comply with the Android UX (user experience) guidelines; (3) distribute product to Android TV devices (and integrate with Android TV features such as universal search, recommendation cards, and voice search); (4) distribute product to Android Wear devices; and (5) distribute product to Android Auto devices. Developers were also required to integrate with Google Cast, to meet parity requirements, to engage in certain marketing activities, and to integrate Google's In-App Billing as the sole payment method. *See, e.g.,* GOOG-PLAY-007272068 (November 2016 Audio Distribution Accelerator Program Addendum with [redacted] GOOG-PLAY-007505116 (July 2021 Audio Distribution Accelerator Program Addendum with [redacted] became the first partner within a related program, referred to as the "Better Together Program." GOOG-PLAY-011124910. As of March 2022, [redacted] would be subject to a [redacted] take rate if a user chooses Google Play Billing and [redacted] if a user chooses [redacted]

387. Terms for the Games Velocity Program often varied by developer. In general, developer obligations included (1) "simship" (the developer will launch all titles on Play on same date or prior to launch on other distribution channel); (2) parity requirements related to content, features, quality, and functionality; (3) non-removal of any titles; (4) expanding title reach across Android; (4) a minimum 4.0 user rating; and (5) good faith effort to include title in the Play Points program; and (6) good faith effort to include title in pre-registration, open beta, and other early access programs. *See, e.g.*, GOOG-PLAY-010511101 (Games Velocity Program Addendum to Google Play Developer Distribution Agreement for [redacted]

388. GOOG-PLAY-007273439 at -40-41; GOOG-PLAY-007847579 at -79-80; GOOG-PLAY-000512004 at -04.

389. GOOG-PLAY-006381385 at -387.

390. *See* [redacted] Rough Dep. Tr. 42:10-43:17 ("[redacted]

entertainment company."[391] Google has also cut in half the take rate for subscriptions, which are not limited to mobile devices. For subscriptions the platform is not as important, and they could command a lower rate. That Google is able to cut special deals below its standard 30 percent take rate for developers with recurring subscriptions or with streaming Apps with large content costs[392] is also consistent with Google having market power. A firm that lacks market power would not enjoy the privilege of discriminating across customer types according to their willingness or ability to pay, but instead would be forced to charge a uniform price at competitive levels.

2. Indirect Evidence

a. High Market Share and Entry Barriers

169. Google accounts for the vast majority the In-App Aftermarket. For example, the [redacted] had total consumer expenditure—across all devices—of [redacted] in 2021.[393] In that year, Google's consumer expenditures in the In-App Aftermarket were approximately [redacted] The vast majority of these consumer expenditures are from In-App purchases.[395] As seen below, from 2018 to 2021, the [redacted] worldwide revenue outside of China has fluctuated between approximately [redacted] Even these estimates are conservatively high, given that the [redacted] In-App aftermarket revenues on Google Android devices are only about [redacted] percent of its total revenue.[396]

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391. *See* [redacted] Rough Dep. Tr. 45:18-46:10 ("Q. Understanding that there are other components to this agreement that may change how this compares to other agreements that developers have with Google, do you have an understanding of what the commission for those developers would be just for Google's Google Play Billing? . . . A. I am aware of Google's published rates. Q. And could you tell me what those published rates were or are? A. For a media entertainment company it would be 10 percent, that share.").

392. *See, e.g.,* Kif Leswig, *Bumble, Duolingo lead rally in shares of App developers after Google slashes subscription fees*, CNBC (Oct. 21, 2021), cnbc.com/2021/10/21/google-cuts-app-store-fees-lifting-shares-of-app-developers.html.

393. AMZ-GP_00005729. The vast majority of these consumer expenditures are from In-App purchases.

394. Sensor Tower, *2022 – 2026 Mobile Market Forecast,* (2021) at 6, go.sensortower.com/rs/351-RWH-315/images/Sensor-Tower-2022-2026-Market-Forecast.pdf. *See also* Sensor Tower, *5-Year Market Forecast: App Spending Will Reach $233 Billion by 2026,* (2022), sensortower.com/blog/sensor-tower-app-market-forecast-2026.

395. [redacted]

396. [redacted]

[redacted]

170. Record evidence indicates that Samsung's share of the In-App Aftermarket is significantly smaller than [redacted] As seen below, consumer expenditures in the Samsung Galaxy Store are [redacted] of those in the Play Store in the U.S.[397]

397. Samsung produced Galaxy Store consumer expenditures limited to the U.S.

[redacted]

171. Moreover, the evidence reviewed in Part II.C.2 above shows that that Play Store accounts for the vast majority of initial downloads on Google Android devices worldwide, which implies that the vast majority of In-App transactions on Google Android devices flow through Google Play Billing. Accordingly, Google has a dominant share of the In-App Aftermarket.[398]

172. Google's In-App Aftermarket Tie-In serves as an artificial barrier to entry in the In-App Aftermarket. Absent this restraint, alternative providers could enter and provide competitive services in support of purchases of In-App Content. The entry barriers for the Android App Distribution Market, described in Part II.C.2.a above, also serve as entry barriers to providers of In-App Aftermarket services. For example, if a rival App store were to gain substantial market share, competitive providers of In-App Aftermarket services could facilitate purchases of In-App Content in the rival store.

b. High Profit Margins

398. As explained in Part V.B.1 below, the ability of a small number of large developers such as Netflix and Spotify to avoid the Aftermarket Tie-In by using their own payments systems does not negate Google's dominance in the In-App Aftermarket. The vast majority of developers in the Play Store are compelled to comply with the In-App Aftermarket Tie-In, and would be excluded from the Play Store if did not comply.

173. As explained in Part II.C.2.b above, Google's financial records confirm that Play Store is highly profitable. These financial records include the In-App Aftermarket, which accounts for the vast majority of transactions and revenue in the Play Store.

IV. GOOGLE'S ANTICOMPETITIVE CONDUCT IN THE ANDROID APP DISTRIBUTION MARKET

174. For the reasons given below, I conclude that Google has engaged in anticompetitive conduct as a means of furthering and retaining its monopoly power in the Android App Distribution Market. In a more competitive but-for world, the Play Store would have competed on the merits with its rivals in the Android App Distribution Market.

A. Google's Exclusionary Conduct in the Android App Distribution Market

175. Anticompetitive exclusionary conduct occurs when a firm impairs its rivals' ability compete instead of competing on the merits. Anticompetitive exclusionary conduct by dominant firms can maintain and enhance monopoly power, harming competition generally and consumers in particular.[399]

176. Google's use of various restraints to maintain its dominance in the Android App Distribution Market inhibits competition from rival App stores on mobile devices and from alternative distribution channels such as sideloading of direct downloads from developers' websites.[400] Such competition would enable consumers and developers to readily connect to more than one competitive platform, a practice known as "multi-homing." A developer can take advantage of multi-homing by discounting the price of its Apps to "steer" consumers to use the lower-cost platform. Steering and multi-homing combined generally would lower the equilibrium take rate charged by each platform. While Google has claimed openness to other App stores,[401] I next discuss how it has effectively utilized contractual restrictions and revenue-sharing agreements

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399. *See, e.g.,* Jonathan Baker, *Exclusion as a Core Competition Concern* 78(3) ANTITRUST L. J. 527 (2013); *see also* Michael Whinston, *Tying, Foreclosure, and Exclusion* 80(4) AMERICAN ECONOMIC REVIEW 837 (1990); Ilya Segal & Michael Whinston, *Naked Exclusion: Comment* 90(1) AMERICAN ECONOMIC REVIEW 296 (2000); Thomas Krattenmaker & Steven Salop, *Anticompetitive Exclusion: Raising Rivals' Costs To Achieve Power Over Price* 96 YALE LAW JOURNAL 209 (1986).

400. *See, e.g.,* METAEPIC_000015079 (employees at Facebook (Meta) discussed in January 2021 how "[s]ideloaded app use case is not a big one [on Android today], mostly because [G]oogle has also tightened that before through a subpar experience (1. You need to go into settings and enable an app for being able to install other apps and 2. Every app install and every update from every app would require a confirmation dialog, putting massive friction to the experience). This wasn't the case few years back, then it became the case. This last [announcement regarding the Advanced Protection Program] basically replaces frictionfull UX and completely removes the possibility of having a third party installer unless it's preinstalled.").

401. *See, e.g.*, Sameer Samat, *Listening to Developer Feedback to Improve Google Play, supra* ("We believe that developers should have a choice in how they distribute their Apps and that stores should compete for the consumer's and the developer's business. Choice has always been a core tenet of Android, and it's why consumers have always had control over which Apps they use, be it their keyboard, messaging app, phone dialer or App store. Android has always allowed people to get Apps from multiple App stores. In fact, most Android devices ship with at least two App stores preinstalled, and consumers are able to install additional App stores. Each store is able to decide its own business model and consumer features. This openness means that even if a developer and Google do not agree on business terms the developer can still distribute on the Android platform. This is why Fortnite, for example, is available directly from Epic's store or from other App stores including Samsung's Galaxy App Store.").

with mobile carriers, OEMs, and developers to restrain competition from other App stores.[402] I also understand that Professor Schmidt finds that Google imposes overly broad technological barriers that inhibit the installation and usage of alternative App stores on Google Android devices, compared with the Play Store.

1. Google's Revenue-Sharing Agreements

177. Before Google had acquired monopoly power in the Android App Distribution Market, Google used revenue-sharing agreements ("RSAs") with major mobile carriers to dissuade competitive entry and expansion by rival App stores. Commencing with Google's rollout of the Android operating system, Google executed RSAs with major mobile carriers. Google's earliest contracts with Verizon and AT&T, the two largest carriers in the United States, are prime examples. In [redacted], as part of a broader agreement, Google entered into a revenue-sharing agreement with Verizon, wherein Google agreed to provide Verizon with [redacted] Google continued to pay Verizon [redacted] From 2010 to 2012, Google paid AT&T [redacted] of Gross Transaction Value" on app credit card sales, leaving [redacted] percent to Google.[405] By 2014, when Google had begun renegotiating these agreements, Google had reached Play Store RSAs on similar terms with carriers around the world.[406]

178. During 2009 to 2012,[407] when Google was retaining up to five percent of the developers' revenues—and ceding the residual 25 to 27 percent of developer revenues to OEMs and mobile carriers—Google was not covering its marginal costs, and thus not covering its average variable costs,[408] of operating the Play Store. According to its financial data, Google's gross profit from the Play Store was negative as late as 2011, and operating profit was negative into 2012.[409] Google's documents indicate that paying carriers 25 percent for distribution of the Play Store would have resulted in losses for Google, making prices below average variable costs on every

402. *See, e.g.*, GOOG-PLAY-003776161.R at -176.R (table on common partner types and what they do, including mobile carriers that "maintain Search exclusivity on devices sold through their channel," and OEMs that "pre-install suite of Google Apps; Google Search exclusivity.").

403. GOOG-PLAY-001400503 at -530 (§ 14.12(b)); GOOG-PLAY4-000284361 at -365.

404. GOOG-PLAY-004542110; GOOG-PLAY-000131205.R at -232.R.

405. ATT-GPLAY-00002235 at -238. When Direct Carrier Billing was involved, the carriers received [redacted] of revenue, leaving even less for Google. *See* GOOG-PLAY-004499366.R at -369.R (noting that "Margins increasing due to (i) Renegotiated carrier deals from [redacted] on DCB and [redacted] on Credit Cards on Apps to [redacted] and [redacted] respectively . . .").

406. *See, e.g*. GOOG-PLAY-001886008.R at -011.R (showing revised app revenue share percentages for various carriers in 2013, with "previous rates" as 25% credit card, 27% direct carrier billing ("DCB") and "new guidance" as 0% credit card, 15% DCB); GOOG-PLAY-000131205.R at -232.R—233.R (2014 presentation showing app revenue share percentages for various carriers at 25% credit card, 25%-27% DCB); GOOG-PLAY-001385324 at -345 (2010 presentation noting that "Rev Share % paid to developers and carriers" is 95 percent total).

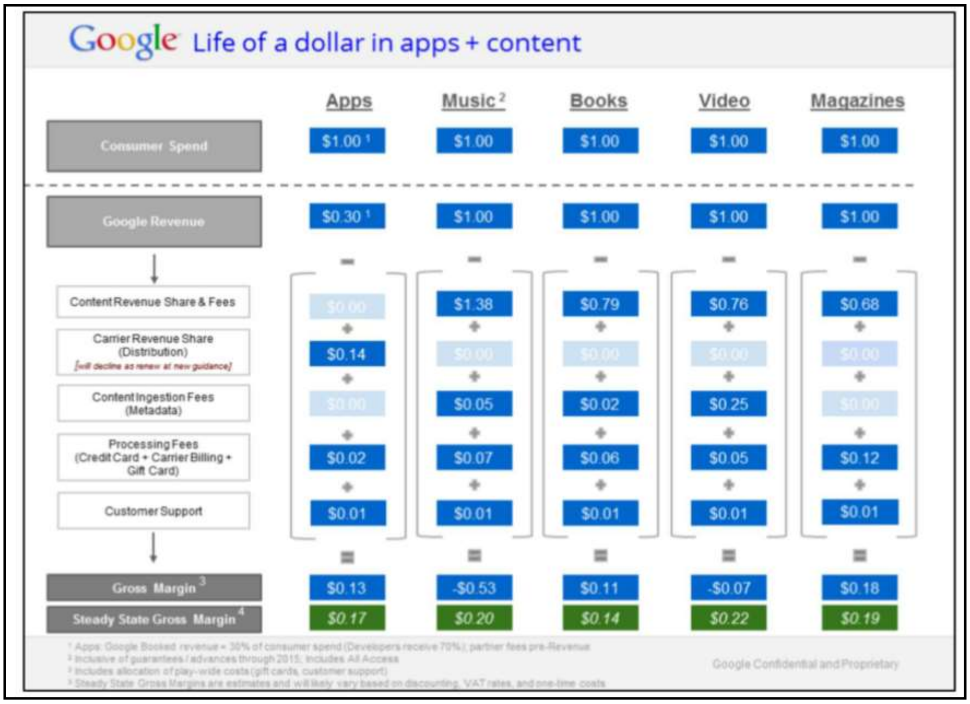
407. *See* Part V.A.1.a.

408. Average variable cost refers to variable costs divided by the *total* quantity of output produced. Marginal cost refers to the additional cost incurred by producing *one additional unit* of output. There may be certain variable costs such as customer support that Google incurs when output expands considerably, but that are not incurred when output expands by one unit. Thus, Google's average variable cost will always exceed its marginal cost. Because Google continues to incur expenses at the margin such as processing fees for each sale, its marginal costs are a good approximation of its average variable costs.

409. GOOG-PLAY-000416245 (showing gross profit of negative $5 million in and operating profit of negative $126 million in 2011. Gross profit is positive $75 million in 2012; operating profit is negative $72 million in 2012).

App transaction involving payment. For instance, an October 2013 presentation indicates that Google's first full year of positive gross margins for the Play Store was 2013 and, based on the fact that its gross margin that year was $0.13 per $1 in consumer spend, Google's gross margins would have approached zero had Google continued to pay $0.25 per dollar to carriers, rather than the $0.14 per dollar it was paying carriers on average in 2013. Testimony from Google witnesses confirms that the Play Store lost money on every App sold when the Play Store kept five percent (or less) of developer revenue.[410]

FIGURE 13: GOOGLE'S GROSS MARGINS ON THE PLAY STORE IN 2013



These 2013 figures indicate that anything approaching a 25 percent payment to the carriers would not have been a sustainable long-term strategy, as it would have been below Google's marginal costs and hence below its average variable costs.[411]

179. Based on its financial data, my best estimate is that Google's marginal costs during the period 2016 through 2020 were approximately [redacted] percent of revenue, which if applicable earlier would have [redacted] its [redacted] percent revenue share net of payments to U.S.

410. Eric Chu, former Head of the Android Developer Ecosystem, testified that Google was losing money when it kept only five percent of developer revenue. Chu Dep. 85:21-86:1. Jamie Rosenberg, VP of Strategy and Operations in Google's Platforms and Ecosystems Division, testified that, when Google was paying carriers 25 percent of developer revenue (and 27 percent with direct carrier billing), Google was losing money on every app it sold. Rosenberg Dep. 186:4-20. Rosenberg testified that 2013 was the first year that Play earned positive gross margins, and that this turnaround was in part the result of Google having negotiated a higher revenue share with carriers. *Id.* at 183:15-22 (discussing GOOG-PLAY-004499366.R at -369). Patrick Brady, a Google executive who worked as a liaison between Android Market and OEMs and carriers, testified that Google lost money on Android Market. Brady Dep. 56:15-20.

411. GOOG-PLAY-004499366.R at -378.R.

mobile carriers.[412] Moreover, Google's marginal costs likely would have been even higher in earlier years, when the Play Store was operating at a significantly smaller scale.

a. Carrier Revenue-Sharing Agreements Eliminated the Threat of Competition from Mobile Carriers

180. In 2009, Google noted that "the greatest threat to Android Market is that carriers can easily set up their own, controlled, application market that will be the default on devices that are not co-developed by Google."[413] Record evidence indicates that Google implemented revenue sharing with carriers to stave off competitive entry by mobile carriers in the Android App Distribution Market. These revenue-sharing agreements involved "giving generous revenue share that more or less matches what they would make from their own markets," until "carriers will be unable to compete with their own offerings because their own offerings will be so limited in comparison."[414] According to Google, "Rev share is a big (if not 'the') reason that carriers are loosening their grip on app distribution."[415]

181. Record evidence indicates that Google recognized that most carriers to which it offered revenue share deals were pursuing their own App stores.[416] Revenue sharing agreements with carriers were designed to incentivize the carriers to promote the Play Store over their own App stores.[417] As one 2014 Google presentation observed, "We cut carriers in to disincentivize building their own stores."[418] Although the agreements did not prohibit carriers from developing their own stores, record evidence indicates that the agreements incentivized the carriers not to compete with the Play Store.[419] A 2019 Google presentation observes that Verizon discontinued its "VCast Apps Store" in 2013 and that this decision "coincided with [the] addition of [a] direct carrier billing option on Play," which gave Verizon the opportunity to earn revenue share from distributing apps on its devices exclusively through the Play Store.[420]

182. Google initially provided major U.S. carriers with the lion's share of the take rate Google extracted from developers (typically 25 percent of App sales revenue going to the carrier, five percent to Google, and 70 percent to the developer).[421] Google was able to sustain such losses via other revenues (such as advertising revenues from Search). As demonstrated below, it eventually anticipated recouping any losses from the early days of the Play Store, after the threat of competitive entry subsided, by curtailing payments to carriers.

412. *See* Table 8, *infra* (showing In-App Aftermarket Impact & Damages (8/16/2016 – 5/31/2022). Row 7 shows marginal cost calculated at [redacted] of consumer expenditures. This includes all direct costs of sales and direct operating expenses. *See also* work papers for this report.

413. GOOG-PLAY-001423609.

414. *Id.*

415. GOOG-PLAY-001381141.

416. *See* Rosenberg Dep. 174:3-181:14; GOOG-PLAY4-000339939; GOOG-PLAY-001381054; GOOG-PLAY-001423609.

417. GOOG-PLAY4-000339939; GOOG-PLAY-001423609.

418. GOOG-PLAY-004565563.R at -567.R.

419. *Id.*; *see also* GOOG-PLAY-001423609; GOOG-PLAY-008427238.

420. GOOG-PLAY-007328714 at -750.

421. GOOG-PLAY-001400503; GOOG-PLAY4-000284361; ATT-GPLAY-00002235; GP MDL-TMO-0080283; GP MDL-TMO-0029572; GP MDL-TMO-0029567; GP MDL-TMO-0029583.

183. According to Tom Moss, Google's Head of Japan new business development, Google perceived the Android Market as the "bitter pill" for mobile carriers, and the revenue share as the "sugar" that makes the pill go down.[422] In 2009, Google's plan was to make the initial offer sweet enough for the carriers so that they would not distribute or invest in their own app stores on their phones. According to one Google document, "The reason we pay T-Mobile rev share is to keep them from creating their own [app] store where they would get far more than 25 percent."[423] Then there would be a "tipping point" when all of the users and developers were wedded to the Play Store, when Google could keep more of the developer revenue for itself.[424] By that point, Google would be able to taper down the payments to mobile operators, which is precisely what it did. Google began reducing the payments to carriers in 2013, and it eventually kept the full 30 percent,[425] easily covering its marginal costs (of approximately eight percent of revenues) and earning an operating profit of $3.7 billion by 2018.[426] By the time the Android App Distribution Market had "tipped" in Google's favor, there was very little chance that a mobile operator would enter with its own app store. Not only did Google plan to recoup its losses from its predatory payments to mobile carriers, it executed its recoupment strategy to perfection.[427]

184. Critically important to Google's predatory strategy was to change the rules in the middle of the game, but only after developers were dependent on Google's ecosystem. Google perceived its strategy as building in multiple "phase[s]."[428] The first phase was "ecosystem building," which spanned 2008 through 2010, and entailed having "multiple OEMs/devices" and "multiple carriers" distribute Android.[429] The second phase was to "extend Google's core business," which entailed extending its power from search and the associated advertisements into adjacent markets such as app distribution. In 2013, Google moved into the final phase, titled "Change the rules/Get a better deal."[430] In June 2009, Google initially recognized that it did "not take a rev-share on Market" because "we don't have a dominant market position right now."[431]

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422. GOOG-PLAY-001423609.

423. Brady Dep. 138:25-143:14.

424. GOOG-PLAY-001423609 ("The solution, of course, is to create consumer demand for Android Market so that the carriers have no choice but to install it and make it easily available. How do we accomplish that? By giving generous revenue share that more or less matches what they would make from their own [app] markets. . . . If we can get carriers comfortable with Market for the near future, there will come a tipping point where consumer demand will be so strong we can set different revenue models and carriers will be unable to compete with their own offerings because their own offerings will be so limited in comparison.").

425. GOOG-PLAY-000443763.R at -772.R.

426. GOOG-PLAY-000416245.

427. Typically, predation is used to denote charging prices below costs. But the term may also refer to a situation when an input provider (here, the carrier or OEM) is paid so much that an equally efficient rival would not find it profitable to match the payment to the input provider while competing, in which case the payments may drive out equally efficient rivals. I understand from Plaintiffs' counsel that, as a legal matter, predation does not require pricing to customers below costs, but also can be established via demonstration that payments to *input providers* do not permit rivals to survive. *See Weyerhaeuser Co. v. Ross-Simmons Hardwood Lumber Co*., 549 U.S. 312, 325 (2007) ("A [predatory-bidding] plaintiff must prove that the alleged predatory bidding led to below-cost pricing of the predator's outputs. That is, the predator's bidding on the buy side must have caused the cost of the relevant output to rise above the revenues generated in the sale of those outputs."). Here, the cost of the relevant output (the cost of operating the Play Store) was approximately eight percent of consumer expenditure, which exceeded the revenues generated in the sale of those outputs (five percent of consumer expenditure) by three percentage points.

428. GOOG-PLAY-001337211 ("Android: OC Quarterly Review – Q4 2010, Oct 12, 2010") at -226.

429. *Id*.

430. *Id*.

431. GOOG-PLAY-011136256 at -287.

After widespread adoption of Google's Android ecosystem and the Play Store, Google could "increase Google net rev. on apps."[432] In sum, Google's anticompetitive strategy for securing the Play Store's dominance entailed changing the rules after millions of users, multiple carriers, and multiple OEMs had adopted Google's ecosystem.

185. As Google's market power grew, Google reduced the carrier's revenue shares (as well as the OEM's revenue shares abroad). In 2013, Google successfully renegotiated revenue-sharing agreements with AT&T, T-Mobile, and Sprint that required the carriers to ensure that OEMs preloaded the Play Store on their devices and gave the Play Store home screen placement.[433] All three of the renegotiated agreements reduced Google's revenue-sharing payments to the carriers, with Google eliminating revenue-share payments from App credit-card sales to T-Mobile and Sprint after 2013.[434] As for AT&T, in 2013 and 2014, Google only paid AT&T five percent revenue share for App credit card sales, keeping 25 percent.[435] After 2014, AT&T's cut was reduced to zero for App credit card sales, with Google retaining the full 30 percent take, despite AT&T's requests to reinstate credit card revenue sharing.[436] And Google finally [redacted] Verizon, [redacted] amending their revenue-sharing agreement in late [redacted] to [redacted] A 2015 internal Google document lauded the multi-million-dollar reduction in the Play Store's cost of sales because Google had "re-negotiated deals with the major carriers at the end of last year which led to significant savings."[438]

186. As actual and potential competition from alternative app stores was eliminated, the carriers had fewer alternatives to the Play Store. As explained below, Google's revenue share agreements also prevented the emergence of non-carrier third-party app stores, leaving the carriers with fewer alternatives. The importance of eliminating competition from carriers is evident in Google's internal documents. Even in 2019, Google noted that cancellation of the remaining carrier revenue share agreements could lead to mobile devices being sold with "an alternative App store (e.g. Amazon Underground)," and that, if "alternative app stores became a viable distribution channel for apps …**Play revenue will be at risk and the MADA would come under pressure**."[439] According to Google, "[c]arriers would configure Android devices in a way most profitable to them," through these "alternative app stores."[440]

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432. GOOG-PLAY-001337211 at -226.

433. ATT-GPLAY-00000692; GP MDL-TMO-0001831; GP MDL-TMO-0002071.

434. ATT-GPLAY-00000692; GP MDL-TMO-0001831; GP MDL-TMO-0002071.

435. GOOG-PLAY-003604606 at -619. AT&T collected 9 percent net GTV for direct-carrier billing transactions.

436. GOOG-PLAY-003604601 at -603. AT&T retained its 9 percent net GTV for direct-carrier billing transactions; ATT-GPLAY-00012846 at -847 (2017 Google document sent to AT&T denying AT&T's request to "to extend rev share beyond DCB transactions").

437. GOOG-PLAY-003605103; GOOG-PLAY4-002178046 at -8049; GOOG-PLAY-002891881 at -882 (2016 internal Google email noting Verizon's complaint that "dcb payments are insignificant and they want the cc back again").

438. GOOG-PLAY4-004677224 at -225; *see also* GOOG-PLAY-001184813 at -823 (2015 internal Google presentation noting Play Store revenue share agreements give carriers "~15% of DCB related consumer App spend (prev. 27% DCB, 25% CC)").

439. GOOG-PLAY-004235359 at -360 (emphasis in original). "MADA" refers to the Mobile Application Distribution Agreement, which is the licensing agreement Google offers OEMs to license Google Mobile Services.

440. *Id.*

187. As explained in Part II.C.2.a, the Android App Distribution Market is characterized by significant the barriers to entry for a rival App store, including strong indirect network effects, which made for a dangerous probability that Google would recoup its early losses. Google's control over mobile devices meant that developers had strong incentives to make their apps Android-compatible; additional apps attracted users, which in turn attracted developers—a virtuous cycle that entrants could not exploit, at least in part due to Google's strategy. Indeed, the probability of recoupment was so high that today we observe no significant competition in the Android App Distribution Market despite the fact that Google has been recouping its initial losses for almost a decade.

188. In short, once indirect network effects kicked in, granting Google an insurmountable monopoly in the Android App Distribution Market, Google was able to discontinue those incentives without fear of losing market share. As Google executive Jamie Rosenberg reportedly later commented: "We cut carriers in to *disincentivize* building their own stores and fragmenting the ecosystem. It worked."[441] Economists recognize how much an early, "first-mover" advantage means to incumbents in the context of network effects.[442]

189. Because Google's revenue-sharing agreements eliminated the threat of competition from mobile carriers (and other potential entrants such as Amazon), and did so in a predatory (below-cost) manner, and because Google was able to recoup the losses from the predatory payments to mobile operators with monopoly profits from future periods, I conclude that this element of the Challenged Conduct was anticompetitive. Furthermore, Google could have partnered with mobile carriers using less-restrictive alternatives. In a more competitive but-for world, Google could have pursued a non-predatory strategy.[443]

441. GOOG-PLAY-000439987.R at -40012.R (emphasis added).

442. *See, e.g.*, Agam Gupta et al., *Combating incumbency advantage of network effects: The role of entrant's decisions and consumer preferences*, 20(1) COMPETITION AND REGULATION IN NETWORK INDUSTRIES 3 (2019); Marvin B. Lieberman & David B. Montgomery, *Conundra and progress: Research on entry order and performance*, 46 LONG RANGE PLANNING 312 (2013), sciencedirect.com/science/article/abs/pii/S0024630113000344?via%3Dihub.

443. I have read and considered deposition testimony regarding so-called "walled gardens" operated by wireless carriers before the Play Store achieved dominance in the Android App Distribution Market. For example, Android founder Andy Rubin testified that walled gardens were the greatest threat to Android Market in 2009. Andy Rubin Dep. 79:16-80:9 ("Q. What did you believe was the greatest threat to Android market at the time [in February 2009]? A. Walled gardens. Q. . . . Do walled gardens include stores opened by carriers for their users? A. So if the carriers had this propensity to run these closed walled gardens where consumers had little choice of where they got their content from, and we're creating a new operating system that could point to any store, it's not a big leap to figure that the carriers will continue to do what they were already doing."). According to Mr. Rubin, "if I was an AT&T subscriber and the only way I could get ring tones was through an AT&T store, I felt like I was locked in because if I were to switch to a Verizon as a customer, as a consumer, then I would lose all my ring tones I got from my AT&T store and I'd have to start over and spend money again on Verizon and do the same thing inside of their walled garden." *Id.* 51:34-52:9. To the extent that Google intends to use walled gardens as an efficiency justification for the Challenged Conduct, I do not find it persuasive. This would be tantamount to claiming that competition in App distribution because would have been harmful to consumers. Although it may be that some carriers have restricted the interoperability of ring tone purchases, I have seen no evidence that carrier stores have ever systematically restricted the interoperability of popular third-party Apps such as Facebook, Netflix, and so on. According to a Stanford Business School case study prepared based on interviews with Google employee Rich Miner, carrier "walled garden" stores before the emergence of Android primarily sold "basic content," such as music, ring tones, and java games, for users of non-internet connected "feature phones." *See* GOOG-PLAY-001146587 at -546; 595-96. According to this study,

b. Revenue-Sharing Agreements Inhibited the Threat of Competition from OEMs and Other Third-Party App Stores

190. Google's carrier revenue sharing agreements also helped to prevent OEMs and other third-party app stores from gaining a foothold in the Android ecosystem. As detailed in the prior section, Google's payments to carriers made its operation of the Play Store (temporarily) unprofitable. This implies that an equally efficient rival that sought to compete with Google by matching (or exceeding) its payments to mobile carriers would not be able to do so profitably.

191. Carrier revenue sharing agreements also inhibited third-party App stores from competing by offering larger revenue shares to developers. Carriers in the United States controlled which App stores were preloaded on devices; without the support of a carrier, third-party App stores faced higher barriers to reaching consumers. Google's high revenue share payments provided economic disincentives for a carrier to preload a third-party App store. An OEM or other third-party App store that attempted to attract developers to their store by offering less than a 30 percent take rate would have had less revenue available to offer to carriers. Record evidence indicates that Google recognized this dynamic. In 2011, a Google employee emailed Android founder Andy Rubin regarding "that bookstore in seattle" (evidently a reference to Amazon), explaining that they appeared to be planning to offer developers a 20 percent take rate, and that Cisco was preparing to offer a 15 percent take rate ("launching an enterprise app store and giving developers 85%.")[444] Mr. Rubin responded, "How do you think they are going to get distribution when we give the carriers 30%?"[445] An Amazon executive testified that "there were conversations about Amazon Appstore preinstalls" with carriers between 2011 and 2013 and "Amazon found it very difficult to achieve any of those preinstall[] deals."[446]

2. Google's Exclusionary Restraints on OEMs

192. I understand that three contracts typically govern the relationship between Google and OEMs. First, OEMs enter Android Compatibility Commitments ("ACCs"), which replaced Anti-Fragmentation Agreements starting in 2017.[447] Broadly speaking, it is my understanding that AFAs and ACCs prevent OEMs from selling any "forked" Android-based devices that do not meet Google's compatibility standards. Provisions in a typical AFA read as follows:

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continuing to operate "walled gardens" in post-Android era would limit the development and availability of applications and reduce overall download revenue. *Id.* at -601. Nor have I seen evidence that wireless carriers would risk losing substantial mobile broadband revenue by forcing prospective customers to delete their popular third-party Apps before joining a new mobile broadband network.

444. GOOG-PLAY-001547487 at -488.

445. *Id.*

446. Morrill Dep. 123-124.

447. GOOG-PLAY-000458664.R (2017 Google presentation that reads, "Starting in April, we will be rolling out a new AFA – known as the Android Compatibility Commitment (ACC)."); GOOG-PLAY-000422837 at -838 (February 2017 email from Google's Hiroshi Lockheimer to a Samsung executive explaining that Google "will no longer be calling it the AFA but rather the ACC -- the 'Android Compatibility Commitment.'"); GOOG-PLAY-000127155 (Standard AFA Agreement signed by Huawei Device (Dongguan) Co. Ltd. Effective April 6, 2015); GOOG-PLAY-000808433 (LG AFA effective 1/25/2011); GOOG-PLAY-000808062 (Motorola AFA effective 10/2/2015); GOOG-PLAY-000808451 (HTC AFA effective 6/14/2012); GOOG-PLAY-003604523 (Samsung AFA effective 5/9/2012); GOOG-PLAY-000416448 (Sharp ACC signed 8/28/2017).

- Company will not take any actions that may cause or result in the fragmentation of Android.

- Company will only distribute Products that are either: (i) in the case of hardware, Android Compatible Devices; or (ii) in the case of software distributed solely on Android Compatible Devices.

- Company may not distribute a software development kit (SDK) derived from Android, or derived from Android Compatible Devices.[448]

193. Record evidence indicates Google considers forks "a huge strategic headache for Google," because they could allow third parties to "grant exclusivity on an Android device to a competitor" or to promote a competitor by preloading its services.[449] OEMs must agree to an AFA (or now an ACC) in order to enter into MADAs, discussed in detail in the following subsection. Both are required to gain access to GMS, which has become critical for many Apps to function.[450] Finally, most OEMs enter into a Revenue Sharing Agreement—whereby Google shares revenue it earns on the device with the OEM.[451]

a. Google's Mobile Application Distribution Agreements Require Distribution and Prominent Placement of the Play Store

194. Google owns some of the most highly valued and widely used Android Apps, including Google Search, Play Store, Maps, Chrome, Gmail, and YouTube. Yet Google refuses to make these Apps individually available to OEMs for pre-installation, instead requiring OEMs to pre-install an entire GMS suite or forgo installation of *any* Google proprietary app.[452] It is all or nothing.[453] As explained in the Majority Report of the Congressional Subcommittee on Antitrust, Commercial and Administrative Law:

> Only through Google's licensing agreements can smartphone manufacturers access Google's proprietary Apps, such as Gmail, YouTube, Chrome, Google Maps, and Google Play Store. In return, Google requires that certain Apps must be pre-installed and must receive prominent placement on mobile devices.[454]

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448. GOOG-PLAY-000127155 (Standard AFA Agreement signed by Huawei Device (Dongguan) Co. Ltd. Effective April 6, 2015).

449. GOOG-PLAY-001559464.R at -469.R.

450. I understand that Professor Schmidt's finds that GMS is necessary for many Apps properly function. *See also* GOOG-PLAY-001559464.R at -473.R ("Can partners sign just the ACC or just the MADA? I guess but this would be kind of pointless, since they need both to get GMS.").

451. *See, e.g.,* GOOG-PLAY-002604372 (July 1, 2020 [redacted] Google Mobile Revenue Share Agreement).

452. Google's MADA refers to these Apps as "Core Applications." *See, e.g.,* GOOG-PLAY-000808375 at -377-378 (2018 [redacted] MADA); GOOG-PLAY-004552342 at -344 (2017 [redacted] MADA § 1.16 including Search, Chrome, Gmail, Maps, YouTube, and the Play Store). In addition to the "Core Applications," some MADAs require installation of region-specific Apps called "Flexible Applications." *Id.* at -344, -347 (§§ 1.15, 3.3). Earlier MADAs defined the applications simply as "Google Applications." *See, e.g.*, GOOG-PLAY-000620996 § 1.1 (2011 [redacted] MADA). *See also* Android GMS, *The best of Google, right on your devices*, www.android.com/gms/.

453. GOOG-PLAY-003776161.R at -177.R (discussing MADA as of 2015: "All of the 11 core Apps must be pre-loaded...OEM's cannot pick Apps a la carte.").

454. *Majority Staff Report* at 212. *See also* GOOG-PLAY-000400751.R at -773.R.

Google recognizes the importance of GMS: "Smartphones aren't very useful without an App store, map app, etc. OEMs need to either license those services through Google or else bear the expense of developing their own services."[455]

195. In addition, Google places a number of proprietary APIs in Google Mobile Services. I understand that Professor Schmidt finds that, without access to those APIs, a mobile device based on AOSP or a forked version of Android will lack access to many commercially important applications. In order to access these critical APIs so that applications can work, and to access certain highly demanded applications, OEMs must sign a MADA with Google to obtain the entire suite of GMS Apps.[456]

196. A typical MADA includes several clauses that require an OEM to give preference to Google Search and other applications in the GMS suite, including the Play Store. GMS Apps must be pre-loaded on devices and prominently displayed on the home screens. Google Search must be the default search engine and must also be given prominent placement.[457] The current MADA also requires OEMs to place the Play Store on the home screens of each mobile device.[458] If an OEM wishes to install just one App from the GMS suite, the MADA requires that the "full suite of Apps, services, and APIs" also be installed, and the number of required Google Apps has increased over time.[459] Collectively, all of the Apps in the GMS suite occupy valuable space on each user's mobile device that otherwise could be occupied by competing App stores or other Apps. In certain agreements, if an OEM wishes to allow deletion by the user of any of the Google Apps, the proportion of deletion-enabled Google Apps may not exceed the corresponding proportion of non-Google preloaded Apps that can be deleted.[460] In sum, Google is able to leverage

455. GOOG-PLAY-001559464.R at -471.R. Google recognizes that "the smartphone business is very competitive: two players, Apple and Samsung, make the lion's share of profits while others operate on very thin or negative margins." *Id.* Licensing GMS, along with revenue shares, can be a "meaningful part of their business," and effectively leave OEMs with no choice but to take Google's conditions. *Id.*

456. GOOG-PLAY-001559464.R at -473.R; *see also* Rosenberg Dep. 189:24-191:1 (testifying that developers write to "APIs that Google provides" and that "if it is an API that is distributed on with, you know, with that package of software on an Android device, then I don't know for certain, but I don't believe that that API would be available on a device that doesn't have Google Mobile Services by definition.").

457. *See, e.g.,* GOOG-PLAY-000025345 at -353—354. *See also* GOOG-PLAY-000400751.R at -773.R ("Recent versions of the MADA require the Google Search widget, Google Play icon and a Google Apps folder icon to appear on the default home screen.").

458. *See, e.g.*, GOOG-PLAY-004552342 at -347 (§ 3.3: "preload on the Default Home Screen … the Google Play Client") (2017 Samsung MADA); GOOG-PLAY-000808375 at -384 (§ 4.4: "[U]nless Google otherwise approves in writing, Company agrees to the following placement and setup requirements … distribute on the Default Home Screen (but excluding the lockscreen and notification tray) … the Google Play Store icon") (2018 Motorola MADA (3PL)). Google's MADA has become more restrictive on where Play must be placed over time. Prior to 2014, the MADA did not require Android Marketplace, the predecessor to Play, to appear on the home screen. GOOG-PLAY-000620996 at -1002 (§ 10.2(a): "Google Search Widget and Android Market Client are presented to the End User on the panel immediately adjacent to the Default Home Screen.") (2011 MADA between Archos SA and Google Ireland Limited).

459. *See* GOOG-PLAY2-000001992 at -1995 ("If a MADA partner chooses to install a GMS App on a device, the MADA requires the partner to install the full suite of Google GMS Apps, services, and APIs on the device in question.").

460. *See*, *e.g.* GOOG-PLAY-004552342 at -348 (§ 3.4) ("If the Company chooses to make any of the Flexible preloads deletable by the End User, the proportion of Google Applications that are made deletable will not exceed the corresponding proportion of deletable preloads from Company."); GOOG-PLAY-001404176 (noting that "most users

the dominant positions of the Apps in the GMS suite to impose restrictions that are designed to further establish and protect its market power in the Android App Distribution Market.[461]

197. Although Google's MADAs do not prevent OEMs from preloading alternatives to GMS,[462] Google exploits the Play Store's prominent status, which works to the detriment of rival App stores, including any pre-installed near Google's App store.[463] Google's documents recognize the value of the Play Store's preferential placement on the home screens of mobile devices, including its importance to Samsung: [redacted] And in questioning whether users and developers would really choose the Play Store, given a choice, a high-level Google employee wrote, [redacted]

b. Google Has Deployed Multiple Measures in the OEM Channel to Ensure That Amazon Would Not Become an Effective Play Store Competitor

198. Google has taken multiple steps to stop competitors from succeeding with a competing App store. Amazon in particular was a potential competitor that has been substantially foreclosed by Google's conduct, which raised the costs to Amazon of competing with its rival App store. *First*, as discussed above, the MADAs mandate installation of the Play Store as a condition of installing any App in the GMS suite. In 2014, Amazon launched a bare Android device called the "Fire Phone," which was not pre-loaded with any of the GMS Apps. Indeed, users were "locked out" by Google from downloading these Apps. Unsurprisingly, consumer demand for a device that cannot include Apps like YouTube, Gmail, or Google Maps was low, and Amazon discontinued

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just use what comes on the device. People rarely change defaults. This underpins our Toolbar and browser chrome distribution models, including iPhone, with data to prove its success").

461. Google's documents establish that the MADA requirements are essential to the Play Store's dominance. GOOG-PLAY-006355073 ("Fortunately, we'll always have the placement/pre-install advantage which is 90% of the battle."); GOOG-PLAY-004494430.C at -433.C ("Google App distribution to get max usage for minimum cost" is one of four issues "MADA seeks to balance").

462. *See* GOOG-PLAY2-000001992 ("Google's MADAs also do not prevent signatories from preloading an alternative to GMS.").

463. Samsung's Galaxy Store is an example of this. As discussed below in Part IV.A.2.c, while the Galaxy Store came pre-installed along with the Play Store on the Galaxy S10 and later models, Google has engaged in a course of conduct designed to discourage effective competition to the Play Store from Samsung. Google has recognized its efforts were effective, pronouncing that "cannibalization of Play store revenue due to Galaxy store" as "none to minimal." *See* GOOG-PLAY-000443908 at -909. Economists recognize, and multiple studies have shown, that defaults can significantly affect consumer choice. *See* Brigitte C. Madrian & Dennis F. Shea, *The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior*, 116(4) QUARTERLY JOURNAL OF ECONOMICS 1149-1187 (2001); Zachary Brown, Nick Johnstone, Ivan Haščič, Laura Vong, and Francis Barascud, *Testing the effect of defaults on the thermostat settings of OECD employees*, 39 ENERGY ECONOMICS 128-134 (2013); John Peters, Jimikaye Beck, Jan Lande, Zhaoxing Pan, Michelle Cardel, Keith Ayoob, and James O. Hill, *Using Healthy Defaults in Walt Disney World Restaurants to Improve Nutritional Choices*, 1(1) JOURNAL OF THE ASSOCIATION FOR CONSUMER RESEARCH 92-103 (2016).

464. GOOG-PLAY-000832471.

465. GOOG-PLAY-000292207.R at -226.R. *See also Id.* at -213.R ("How many users and developers are actually choosing Google Play vs. going with the default product . . . [?]"); GOOG-PLAY-006355073.

the device within a year.[466] The MADAs prevented an OEM from customizing the Apps on mobile devices by precluding an alternative bundle comprised of a rival App store (including Amazon's App store) alongside Google's other popular (non-Play Store) Apps—that is, a rival App store would need to compete across every dimension of Google's App suite at once, effectively raising its costs. Without a successful "Fire Phone" due to Google's restrictions, Amazon was less likely to fully compete in the Android App Distribution Market by investing and developing a mobile App store that would rival the Play Store in scope and reach.[467]

199. *Second,* in 2015 Amazon released a backdoor to the Amazon Appstore (Amazon's App distribution store) through the Amazon App (Amazon's shopping App) that was available for download on the Play Store. As one media outlet noted, "The move effectively turns Amazon's flagship application—an App that has somewhere between 50 million and 100 million installs, according to Google Play's data for the smartphone version—into an App store App that directly competes with Google Play, while also being sold on Google Play." [468] Google quickly forced Amazon to update its App to remove this functionality.[469]

200. *Third*, using its control over access to the GMS suite and the dominant position of the Play Store in the Android App Distribution Market, Google was able to introduce additional restraints that strongly discouraged use of bare Android devices. For example, consumers who had purchased an App via the Play Store were prohibited from re-downloading that App to a bare Android device that could not include the Play Store. These consumers would have to repurchase the same App on their bare device to keep using it.[470] Accordingly, consumers wishing to move to non-Google Android devices, such as the Amazon "Fire" phone, would be required to repurchase all Apps they had previously purchased from the Play Store or contact the developer directly to request a free download on the new device.

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466. Benjamin Edelman & Damien Geradin, *Android and competition law: exploring and assessing Google's practices in mobile*, 12(12-3) EUROPEAN COMPETITION JOURNAL 159, 167 (2016) [hereafter Edelman & Geradin].(citing Geoffrey Fowler, *Amazon Fire Phone Review: Full of Gimmicks, Lacking Basics*, WALL STREET JOURNAL (Jul. 23, 2014), wsj.com/articles/amazon-fire-phone-review-full-of-gimmicks-lacking-basics-1406077565).

467. *See* GOOG-PLAY-001317740 at -741 (2011 Google summary of competing App stores: "*Amazon making play at mobile content distribution* with launch of Appstore for Android… *branded headseat (Amazon Blaze) on the horizon*.") (emphasis in original); GOOG-PLAY-001451619 (Google negotiators recommend rejecting any requests from Amazon to modify MADA for Fire devices, knowing GMS would make the device stronger but competing App stores would cause "fragmentation."); *see also* GOOG-PLAY-007657997 at -8010 (2017 concern that although Amazon's App store "lacks critical mass of users and developers today," "[i]f they can achieve either, we believe this will create a virtuous cycle drawing in more users and developers – increasing appeal of Fire devices and greatly increas[ing] the severity of the threat.").

468. GOOG-PLAY-000832219 at -221.

469. Google's Jamie Rosenberg made this clear in an email to Sameer Samat on March 14, 2015. GOOG-PLAY-000832219 ("New downloads of the Amazon Mobile App (as of 12/12) would not have App Store functionality.").

470. Edelman & Geradin at 167 (citing Fowler, *Amazon Fire Phone Review*). The Nokia X phone, also launched in 2014, met a fate similar to the Amazon Fire Phone for these reasons. *Id*.

c. Google Discouraged Samsung from Effectively Competing with the Play Store in the Distribution of Apps in the Android App Distribution Market and Entered into Deals with Developers to Mitigate the Risk of Competition from Samsung

201. Google's treatment of Samsung, the largest Google Android OEM, illustrates Google's recognition of the potential competitive threat posed by a competing App store and the lengths Google would take to avoid such competition. Google engaged in numerous detailed, strategic programs to "mitigate challenges" posed by Samsung's expansion of its App store,[471] "Samsung Apps," later rebranded as the "Galaxy Store."

202. As early as 2011, Google recognized that competition from a Samsung App store could be "destructive" to Google Android because it would lead to "developer exclusives, competing business models, etc."[472] Google also feared that Samsung could secure exclusivity of popular new Apps meaning that "the App is available on Samsung stores or devices and not on Play for a period of time, usually months."[473] Pre-loading of the App store on all Samsung devices would allow Samsung to "shift consumer behavior away from shopping for Apps and games in the Play Store. This fundamentally impacts Play store effectiveness."[474] Google's goal was: "[G]et them to stop distributing Apps through Samsung App store"[475] or otherwise "duplicat[ing] our services on Android."[476]

203. Once Samsung's Galaxy Store was open, Google executives referenced a stated "desire between the parties to reduce competing services."[477] By July 2014, Samsung reassured Google, "We definitely don't want to compete with Play store."[478] To Google, Samsung minimized its efforts, emphasizing that its new store would be limited to a few hundred Apps, predominantly Apps "customized for Galaxy specific features, such as S Pen and multi-windows," with App categories reduced from 24 to 10. Effectively, Samsung was moving from "a department store approach," to "a small boutique store…."[479] A few days later, following a meeting between Google and Samsung executives, Google noted with reference to Samsung the "winding down of their effort to [create] a full-on App store, as they realize it doesn't make sense to try to compete with us in this area."[480]

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471. GOOG-PLAY-000004762.R at -764.R; *see also* GOOG-PLAY-000367346.R.

472. GOOG-PLAY-006359924 at -925 (explaining "we don't believe Samsung should be cultivating its own developer ecosystem").

473. GOOG-PLAY-006359924.

474. *Id*. at -925.

475. GOOG-PLAY-001438299 at -300. *See also* GOOG-PLAY-004253884 at -907 ("Samsung is competing directly with Google, positioning itself to control more consumer touch points and to enhance control over the home-screen").

476. GOOG-PLAY-001449339 at -340 (explaining "Samsung's duplication of our services on Android" was "one of the critical issues with the partnership right now" and the presence of the "Samsung Apps relative to Google Play" was the "most glaring" example of such duplication).

477. GOOG-PLAY-000417080.

478. GOOG-PLAY-001455849 (explaining the Samsung App store had "grown to a store with 70k Apps," but it had not done well).

479. *Id*.

480. GOOG-PLAY-001847447 at -448 (explaining "Galaxy Apps is a parking place for 'less than 1,000 Apps' that showcase Samsung devices in some way.").

204. In 2018, Google learned that Samsung was aggressively "expand[ing] their ambitions in App & game distribution" with new launches and "actively reaching out to top game developers and asking them [to] consider distribution through Samsung Galaxy App store first or instead of via Play."[481] It also learned that Samsung had "moved the Galaxy Store App icon to sit on the default home screen, next to the Play Store. Previously, it was +1 away."[482] Google's CEO responded by asking Samsung's Chairman to "consider partnership with us in this area, rather than fragmenting user and developer experience."[483] Shortly thereafter, Google proposed making cash payments and other incentives to Samsung if it agreed to limit its offerings and "[r]etain prominent Play branding" within the Samsung store.[484] Specifically, Google offered to host the Galaxy Store "on Play, served via Alley-oop,"[485] and pay Samsung $250 million over a four-year contract. These efforts, known as "Project Banyan" were designed to prevent the Galaxy Store from fully competing with the Play Store by spending "money on game exclusives and deals with the goal of: 1. Increasing devices sales 2. Increasing service revenue through the Galaxy Store."[486]

205. Google's Jamie Rosenberg confirmed that the effect of Google's Project Banyan proposal to Samsung would have been that Samsung and Google would not compete for the time of developers' engineers and would not have competing commercial terms for developers.[487]

206. But Project Banyan alone was not enough to address Google's ongoing fears of competition from Samsung.[488] Google remained concerned that:

- Samsung could drive more developers and users to its store by discounting its rev share to developers as "payment" for exclusives and unique content, and by using "[p]romotions and discounts to users to use their store using notifications, emails, etc."[489]

- Samsung could respond "with a very public and disruptive rev share model (i.e., it just decides that it will take only 5% and use its App store for purposes of building [form of payments] and user profiles and differentiating devices.[])"[490]

207. "[I]f Samsung wins the hearts & minds of developers on this, it could create enormous pressure on us to unblock their opportunity one way or another," and while developers

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481. GOOG-PLAY-004509271 at -272.

482. *Id*.

483. *Id*.

484. GOOG-PLAY-000004762.R at -4785.R. *See also* GOOG-PLAY-000367346.

485. The technical processes known as "Alley-oop" was a critical part of Google's offering. As described by Google, "Alley-oop" meant that Google provided the "delivery infrastructure for Samsung's Galaxy Store" whereby any download would appear to the user as occurring "through Play without leaving the Galaxy Store." GOOG-PLAY-000464148 at -150. It would also "apply to Game Launcher and any other Samsung product where Apps can be downloaded through the Galaxy Store today." *Id*. In practical terms, that meant Google would continue to receive its 30 percent share of any paid App download through the Galaxy Store, and Samsung could not entice developers with lower take rates. *Id*. at -149—150.

486. GOOG-PLAY-000367346.R at -347.R.

487. Rosenberg Dep. 114:24-115:22 (discussing GOOG-PLAY-007246367).

488. *Id. See also* GOOG-PLAY-007384816 at -818 (Rosenberg: "I said we put a lot of thought into our proposal about how to align incentives to have a single voice to the ecosystem, and so that the teams were not out competing with each other.").

489. GOOG-PLAY-001877016.C at -020.C—021.C.

490. *Id*. at -020.C.

"will tolerate some premium pricing for distribution through Play / Google and all that we provide, but not a gap that wide."[491]

e. Google's New Revenue Sharing Agreements With OEMs Are Designed To Further Entrench the Play Store's Monopoly

208. Google has further insulated the Play Store from competition through its most recent series of OEM agreements. Stylized as Google Distribution on Android Framework ("GDAF"), or "Google Forward," these agreements [redacted] on the absence of any pre-installed third-party Apps that compete with Google Apps, including third-party App stores.[492]

209. I understand that Google chose to enter into these agreements after certain OEMs had begun to build out distribution to a sufficiently large scale that could allow third-party stores to compete with the Play Store if successfully preloaded.[493] Premier Tier payments compensated OEMs on a [redacted] if the OEM agreed not to allow third-party App stores to be preinstalled on each Premier Tier device.[494] The RSA payments offered by Google were economically significant, as Google expected total spend to be nearly [redacted] in 2020 and up to [redacted] in 2023.[495] Indeed, Google's stated goal was [redacted]

210. Google's RSA agreements prohibiting the pre-installation of competing App stores affected a growing and substantial portion of Android devices shipped. Google has entered into RSA agreements with at least [redacted] OEMs to date.[497] In 2020, based on projections for [redacted] OEMs

491. *Id.*

492. *See* GOOG-PLAY-004489416.R; GOOG-PLAY-000443763; GOOG-PLAY-004494430.C; GOOG-PLAY-004486928.R.

493. GOOG-PLAY-000443763.R at -773.R..

494. *Id.* at -775.R.

495. GOOG-PLAY4-007239946; *see also* GOOG-PLAY-001555373 (explaining the amount Google would pay for Play protection as part of RSA 3.0 was "based on a couple of things" including: "a) What Xiaomi [a Chinese OEM] signaled to us would be worthwhile for them to take the Google forward tier (largest partner for Forward devices), and b) We did an analysis on how much Xiaomi earns through their 1P services, and triangulated into a dollar amount that we would need to pay to make it worthwhile for them. Other OEM rates were a subset of these.")

496. *Id*. *See also* GOOG-PLAY-001555373 (explaining "[t]he deal is to secure commitments on a Global basis. If we don't align incentives on the Play store, we believe there is a non-zero risk of the following scenarios materializing: • Huawei and Chinese OEMs begin pushing their app store on devices outside of China . . . • At the same time, if we did not structure a deal with Samsung, they would continue to heavily promote their own app store, which would then start to grow in scale . . . • European carriers would then see an opportunity to invest, pushing their own Carrier app stores which we know is preloaded on devices already in some markets • The worst risk to come out of this is that Chinese OEMs and Samsung will no longer need the Play store for Apps on their phones, which would then weaken the leverage the MADA provides • Without MADA, we would not be able to incentivize placement of Widget, which drives ~50% of search revenue on a device and secures other 1P apps like Chrome and Assistant").

497. GOOG-PLAY-000620210 [redacted] GOOG-PLAY-000620638 [redacted] GOOG-PLAY-005706338 [redacted] GOOG-PLAY-008111867 [redacted] GOOG-PLAY-001745614 [redacted] GOOG-PLAY-000416708 [redacted] GOOG-PLAY-000620282 [redacted] GOOG-PLAY-000620442 [redacted] GOOG-PLAY-000620131 [redacted] GOOG-PLAY-005706436 [redacted] GOOG-PLAY-005706676 [redacted] GOOG-PLAY-007038477 [redacted] GOOG-PLAY-007038511 [redacted] GOOG-PLAY-000620478 [redacted] GOOG-PLAY-005706728 [redacted] GOOG-PLAY-000416651 [redacted]

who had then signed Google Forward agreements, Google anticipated [redacted] Premier Tier devices to ship in 2020 and 2021.[498] According to Google's internal estimates, as of January 2021, [redacted] devices sold were "Premier Devices," and this was expected to increase in 2021.[499] For some OEMs, all or nearly all of their devices sold in January 2021 were "premier tier," demonstrating the power of Google's revenue sharing terms.[500]

211. The RSA agreements substantially foreclose some of the remaining and most viable distribution avenues for competitive App stores. Indeed, as early as 2014, Google employees recognized that the company might be able to "stem the tide of emerging App stores" by "bring[ing] OEMs closer to us . . . with stricter placement requirements through rev share."[501] The RSA agreements also foreclosed competition from OEM app stores. For these agreements, Google targeted those groups of OEMs that were building, according to its internal documents, "significant distribution scale."[502] Google planned to "incentivize OEMs to prioritize Play" with these agreements.[503] "Prioritizing Play" meant preloading "Play as the exclusive App store on devices."[504] As of 2019, Google's plan was to move "all current non-Samsung RSA partners" to its RSA agreements.[505] Google's internal documents indicate that it focused on "non-Samsung RSA partners" because Samsung was investing in its own Galaxy Store.[506] These new, broad restrictions on potential third-party competitors serve to further entrench the Play Store's dominance.[507]

212. Because Google's exclusionary restraints on OEMs eliminated the threat of vigorous OEM-based competition in the Android App Distribution market, I conclude that this element of the Challenged Conduct was anticompetitive.

3. Google's Exclusionary Android App Distribution Market Conduct and Restraints with Respect to App Developers

a. Google's Developer Distribution Agreements and App Campaigns Program Are Exclusionary

213. Google's agreements with developers inhibit competition from rivals in the Android App Distribution Market by prohibiting the distribution of competing App stores through the Play Store and by prohibiting developers from steering users to lower-priced App distribution channels or using user information learned through the Play Store. Developers are precluded from using the Play Store "to distribute or make available any Product that has a purpose that facilitates

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498. GOOG-PLAY-008006134.
499. GOOG-PLAY-003894142.R at -172.R. I understand that Plaintiffs do not have updated discovery from Google to determine the number of current devices that ship under Premier Tier terms.
500. *Id.* at -173.R. [redacted] premier tier for [redacted]
501. GOOG-PLAY-000449614 at -615.
502. GOOG-PLAY-000443763.R at -774.R.
503. *Id.*.
504. *Id.* at -775.R.
505. GOOG-PLAY4-007239946 at -947.
506. GOOG-PLAY-004502766.
507. GOOG-PLAY-001555373 (explaining, that "Philipp [Schindler, a Senior Vice President and Google's Chief Business Officer] is starting to become more comfortable with the payments on Play to OEMs in order to protect our app store after learning that losing Play protections could lead to a material drop in the value of MADA . . .").

the distribution of software applications and games for use on Android devices outside of Google Play."[508] Nor can developers steer consumers to other platforms or websites to purchase or download Apps or In-App Content: "You may not use user information obtained via Google Play to sell or distribute Products outside of Google Play."[509]

214. In addition, to access Google's App Campaigns program, Android App developers must list their Apps in the Play Store.[510] Only Apps that were distributed in the Play Store could participate in Google's App Campaign program, a program specifically designed to allow developers to place ads for Apps and In-App Content on Google's self-proclaimed most valuable properties.[511] Those "properties," which are specially optimized for the advertising of mobile Apps, included Google Search, YouTube, Discover on Google Search, and the Google Display Network. Google was explicit about this linkage in its marketing, representing that placement in the Play Store enabled developers to "get your App into the hands of more paying users" by "streamlin[ing] the process for you, making it easy to promote your Apps across Google's largest properties."[512] This conduct further entrenched Google's monopoly in the Android App Distribution Market by coercing developers to list their Apps in the Play Store or risk losing advertising access to some of the Internet's most effective advertising space.

b. Google's Project Hug Agreements Are Anticompetitive

215. Google also introduced "Project Bear Hug," later shortened to "Project Hug," which imposed a contractual requirement on major Play Store developers to prevent App stores from entering "exclusives for the most lucrative and risky developers."[513] Project Hug was a key

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508. *See* Google Play Developer Distribution Agreement (as of Jan. 4, 2014) ("You may not use the Market to distribute or make available any Product whose primary purpose is to facilitate the distribution of software applications and games for use on Android devices outside of the Market."); Google Play Developer Distribution Agreement (as of Sep. 25, 2014) ("You may not use the Store to distribute or make available any Product which has a purpose that facilitates the distribution of software applications and games for use on Android devices outside of the Store."); Google Play Developer Distribution Agreement (effective as of June 12, 2020) ("You may not use Google Play to distribute or make available any Product that has a purpose that facilitates the distribution of software applications and games for use on Android devices outside of Google Play."). For years, dating at least back to 2008, Google called this the "Non-Compete" provision. *See, e.g.*, GOOG-PLAY-000054021 at -022; GOOG-PLAY-000054683 at -685 (2008 version). By 2014, Google had dropped this label in favor of calling the provision "Alternative Stores." Compare GOOG-PLAY-000054039 at -041 (2014 version) with GOOG-PLAY-000053975 at -977 (2017 version).

509. GOOG-PLAY-000053875 at -876 (Google Play Developer Distribution Agreement (effective as of Nov. 17, 2020), point 4.9).

510. Google Ads Help, *About App campaigns,* support.google.com/google-ads/answer/6247380?hl=en.

511. *See* GOOG-PLAY-000226999 at -6999—7001 (Co-marketing fund agreement) [redacted]

512. Google Ads Help, *About App campaigns,* support.google.com/google-ads/answer/6247380?hl=en.

513. *Id.* at -019.C.

element of Google's effort to prevent developers from supporting a rival App store.[514] Like Google's payments to OEMs and mobile operators, Project Hug followed a simple formula: pay the potential competitor enough to prevent it from going "off-Play" or from giving a competitor such as Samsung exclusive content, but less than Google's expected loss from damage to its monopoly.[515]

216. As detailed below, Project Hug is shown to be anticompetitive through the economic lens of an MFN imposed by a dominant firm. When employed by dominant platforms such as Google, MFNs have been recognized as impairing competition.[516] Project Hug is also anticompetitive when viewed through the economic lens a dominant firm that makes payments to induce would-be horizontal rivals not to compete against it. Economists recognize that harm to competition occurs when a monopolist or dominant firm pays rivals not to compete. Such payments effectively share monopoly profits with actual or prospective rivals as an inducement to prevent competition from breaking out.[517] Economists recognize that "paying competitors to stay out of the market may be profitable, but doing so reduces competition and is likely to attract very close antitrust scrutiny."[518]

217. Known internally as the [redacted] requirement, Project Hug required developers to [redacted] Google's documents indicate that Projects Banyan and Hug

514. GOOG-PLAY-000445443.R at -458.R. Externally, in negotiations with developers, Google referred to Project Hug as the "Games Velocity Program" ("GVP"). *See* GOOG-PLAY-000932349. Google required developers who signed GVP agreements to keep the deal confidential. *Id.* at -352 ("Neither party may make any public statement regarding this Addendum without the other's written approval.").

515. Another important component of Project Hug was Google's effort to limit the ability of Samsung's Galaxy Store to compete effectively. GOOG-PLAY-000000807. Google's Business Council simultaneously approved Project Hug and efforts to engage Samsung in a four-year commercial agreement that would promote Samsung's "goals to create a services business, to differentiate their device offering and to enable incremental monetization, while promoting Play on Samsung devices and improving the Android gaming experience." *Id.* at -808. In support of this endeavor, Google would offer Samsung [redacted] *Id.* at -809. In return, [redacted] only App stores on default home screen, [redacted] *Id.* at -810—811. This project later became known as "Project Banyan" and is discussed in Part IV.A.2.c above.

516. *See, e.g.*, Jonathan B. Baker & Fiona Scott Morton, *Antitrust Enforcement Against Platform MFNs*, 127(7) YALE LAW JOURNAL 2176-2202, 2177 (2017) (studying the effects of MFNs under an "agency distribution model," whereby "the platform does not take ownership of the good (*e.g.*, the hotel room) but sells it on behalf of the owner at a price chosen by the owner").

517. *See, e.g.,* Carl Shapiro, *Antitrust Limits to Patent Settlements*, 34(2) RAND JOURNAL OF ECONOMICS (2003), 394. ("A hallmark of these anticompetitive agreements is that the patentholder agrees to share its monopoly profits with the challenger in order to induce the challenger to give up its fight.") *Id.* at 393 ("Precisely because patent settlements can be anticompetitive, and because settling parties may have an incentive to insert anticompetitive provisions into their agreements, antitrust interest in the settlements of intellectual property disputes is very high.")

518. Jeremy Bulow, *The Gaming of Pharmaceutical Patents*, *in* INNOVATION POLICY AND THE ECONOMY, 145, 159-73 (Adam B. Jaffe et al. eds., 2004) at 146. *See also* Steven Salop, "Potential Competition and Antitrust Analysis: Monopoly Profits Exceed Duopoly Profits," *Georgetown Law Faculty Publications and Other Works* No. 2380 (2021), https://scholarship.law.georgetown.edu/facpub/2380

519. GOOG-PLAY-000000807 at -810. *See also* GOOG-PLAY-011269238 at -344-345 (showing impact of [redacted] requirement on developer revenue).

worked together to enable Google to continue to reap the rewards of its supra-competitive take rates, by (1) limiting Samsung's Galaxy Store catalog, which minimized the effectiveness of any "deep discounts" Samsung might offer;[520] and (2) drafting contract terms that "[d]isincentivize broad discounts (across many / all Apps to siphon engagement away from equivalent Play app)."[521]

218. Project Hug also imposed [redacted] provisions on certain developers, specifying that developers [redacted] when distributing their Apps and In-App Content through competing App stores or other platforms. For example, one Google document states, "Our GVP deal with [redacted] Such provisions preclude steering to alternative platforms based on a lower price (or a lower quality-adjusted price).

219. [redacted]

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520. GOOG-PLAY-000464148 at -151.
521. *Id.*
522. GOOG-PLAY-007755618.
523. [redacted]
524. GOOG-PLAY-007424789 (discussing how Riot was developing their own "inhouse 'App store'"). *See also* Koh Tr. 200:4-16 ("Q. And some of the Project Hug developers specifically told Google that they were considering starting their own competing Android app stores; right? A. That is correct. Q. Riot was one of those? A. That is correct.").
525. GOOG-PLAY-007424518 at -522 (explaining that Supercell was contemplating "other options" including "launching games on new/other Android Stores").
526. GOOG-PLAY-007421525 (discussing how Tencent was developing their own subscription platform); *see also* Koh Tr. 278:24-279:2 ("Q. And it also references Tencent and Epic's efforts to explore business models that do not involve Google Play for Android; right? A. Yes, that is correct.").
527. GOOG-PLAY-007424789.
528. [redacted]
529. GOOG-PLAY-007424789; *see also* Koh Tr. 286:14-24 ("Q. And you're summarizing here in the second paragraph that 'Riot was on the verge of becoming the next major game company to follow Epic in moving forward with an off-Play Android distribution strategy.' Do you see that? A. Yes, I see that. Q. And you said that you offered a Hug-like deal to convince Riot to change that strategy; right? A. Yes, that is correct.").

[redacted]

220. One of the key Google employees responsible for implementing Project Hug has admitted that the terms of the Project Hug agreements, which prevented developers from giving any exclusive or unique content to competitors, including Samsung's Galaxy Store, have effectively mitigated the competition from Samsung. Mr. Koh explained that Project Hug's sim-ship commitment was aimed at ensuring "developers were prioritizing Google Play when they were thinking about launching a new game or a major new content update"[531] and that Google was concerned that developers might strike deals to distribute Apps first through Samsung's Galaxy Store.[532] Project Hug prevented those developers, however, from launching a different version of their game or an early release of their game on Samsung Galaxy or other competing stores. Mr. Koh viewed Project Hug as "mitigating our risk of losing out to competition" from Samsung and other competitors.[533] In this way, Project Hug impaired competition from other stores.

221. At the same time, in June 2019, a Google executive referred to Project Banyan, noting, "[W]e are having a conversation with [Samsung] (confidentially) about them getting rid of their own App store which they are using right now to get game devs to do unique things for their devices in exchange for no rev share (for example)—this is destructive to everyone and they are coming around but it may also require we help them on the economics of stores because they would be giving up something."[534]

222. While Google "halt[ed] work" on Project Banyan in July 2019 and instructed its employees to "not proceed with the related work streams involving our respective App store,"[535] its efforts to minimize competition from Samsung's Galaxy Store had already been effective. In 2019, Google executives presented a "Galaxy Store Performance Update" concluding that the Galaxy Store was unable to meaningfully compete with the Play Store as the Galaxy Store "continues to lack compelling differentiation in terms of new exclusive titles or [In-App Products],"[536] and that "the cannibalization of Play store revenue due to Galaxy store is none to minimal."[537] This result stemmed from the "firewall that Galaxy store is limited to promotion and curation only for Samsung exclusives" and Samsung's reluctance to "start conflicting with Play curation."[538]

530. GOOG-PLAY-004696168.R at -174.R. The deal "tie[d] incentives to growth on Play over three years to mitigate off-Play platform investments." *Id.* at -170.R. Google was concerned not only with "alternative distribution risk" but also "alternative monetization risk," as Tencent threatened to "build an off Play payments platform." *Id.* at -169.R, -176.R. To mitigate this "off-Play payments risk," Google "[tied] Hug offers to Play Spend." *Id.* at -169.R.

531. Koh Dep. 362:18-363:1.

532. *Id*. at 364:13-365:4.

533. *Id*. at 366:25-367:16.

534. GOOG-PLAY-002994573 at -574.

535. GOOG-PLAY-004136427.

536. GOOG-PLAY-000443908.R at -911.R.

537. *Id.* at -909.R. The same document presents store engagement metrics indicating that user engagement in the Galaxy Store was minimal in comparison to the Play Store. *Id.* at -913.R (showing Galaxy Store "Sessions/User" metric at just [redacted] percent of the Play Store, and "Time in App/User" metric at just [redacted] percent of the Play Store).

538. GOOG-PLAY-000367346.R at -351.R.

223. Google's subsequent analysis of a major game release, [redacted] confirmed the Update's findings and estimated the [redacted] (across all Apps), or between [redacted] of the amount consumers spent on the same Apps on the Play Store.[539] Thus, Google's pressure and its Project Hug agreements thwarted Samsung's efforts to differentiate its product offerings through exclusives with developers offering unique content at lower prices. Otherwise, more developers and consumers would have been attracted to the Galaxy Store. Google was able to achieve this result even though Samsung was a sophisticated, well-resourced market entrant that secured broad pre-installation of its own App store.

224. Project Hug provided incentives in the form of co-marketing agreements, Google advertisement credits, consultative services, commercial investments, Google Cloud Platform credits, or eSports and YouTube packages.[540] The benefits were significant, typically amounting to around three to five percent of total consumer spend on the developer's paid Apps and In-App Content in the Play Store.[541] In return for these payments, Google required that developers invest in the Play Store (towards Google cloud credits, incremental Google ads spend, or co-marketing in the Play Store), maintain all titles on the Play Store, and commit to simultaneously ship ("sim-ship") all titles on the Play Store the day of a game's launch.[542]

225. Google's Project Hug and the sim-ship requirement in particular proved successful. Within one year, [redacted] game developers had signed Games Velocity Program Agreements.[543] One of the holdouts, [redacted] a popular gaming developer, said that it was considering launching its own "Off-Play Webstore" to avoid Google's commission charge.[544] According to Google, if [redacted] were to migrate all of its spend off Google, the impact would be

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539. GOOG-PLAY-000001317. In a 2019 internal email referencing "top games" such as Harry Potter Wizards Unite ("HPWU") and Pokémon GO ("PG"), Google's Christian Cramer asked, "[a]re we tracking how much traction these top games get on other platforms such as the Galaxy store?" In response, Google's Brian Brazinski reported that Monthly Active User ("MAU") and Daily Active User ("DAU") metrics for the Galaxy Store were only a small fraction of those for the Play Store ("MAU/DAU for both HPWU and PG are -1-2% of Play DAU/MAU"). *Id.* at 318. Similarly, "Total hours played on Galaxy apks -1 % of game time on Play apk." *Id.* More broadly, the same document also estimated that aggregate consumer spend for Apps and Games ("A&G") in the Galaxy Store was about two to three percent of those in the Play Store. *Id.* at 317 ("Galaxy Store grosses $360-$550M today in A&G consumer spend (between 2-3% of Play A&G spend[.]").

540. *See, e.g.,* GOOG-PLAY-000559379.R at -382.R and -384.R; GOOG-PLAY-000000807; GOOG-PLAY-000229696; GOOG-PLAY-005027813 (showing Hug-approved budget, developers and their expected 2020 Play spend, along with marketing, cloud credits, YouTube presence, and eSports tournaments incentives). Through providing such incentives, Google could gain a foothold through "Court[ing] Top Developers." *See* GOOG-PLAY-011269238 at -251, a February 2018 slide deck describing "Project Banyan, Hug and RSA/Play Kicker: Risk & Leakage Models.".

541. GOOG-PLAY-000559379.R at -382.R—383.R ("In a typical deal, Play reinvests [redacted] *See also* GOOG-PLAY-004119228.R at -237.R ("Effectively, GVP is a cross-Google deal structure where by [*sic*] Play takes [redacted] a developer would have owed Google and allows the developer to reinvest those dollars towards [redacted]

542. GOOG-PLAY-000000807 at -810-811.

543. GOOG-PLAY-000001976.

544. *Id.* [redacted] is therefore considering [whether] to launch their subscription service in an off-Play Webstore to get the economics they aspire.").

[redacted] in spend from 2019-22."[545] Google, aiming to "[m]itigate the risk" of [redacted] defection from Google Play, made an offer to [redacted] that involved revenue-sharing incentives and "reinvesting" customer spend into mutually beneficial marketing activities.[546] By April 2020, Google had offered [redacted] a [redacted] reinvestment[] on all SKUs."[547] Shortly thereafter, [redacted] signed a Project Hug agreement.[548]

226. Altogether, Google estimated that Project Hug resulted in [redacted] (2019-2022)," while also driving an [redacted] dollars in cross-platform revenue.[549] Google also noted that signed Project Hug developers had stopped "escalat[ing] about rev share to date" and were "leaning into Play & Google partnership."[550] In 2020, Google decided to double down and rolled out the Games Velocity Program 2.0, offering Project Hug-like benefits to the next 12 largest game developers.[551]

227. Google's "sim-ship" requirement that game developers release all games on the Play Store on the game's day of launch can be understood as a most-favored-nations ("MFN") clause foreclosing competing App stores from entering into exclusive arrangements with developers whereby, in return for a substantial payment, the developers agree to launch a title exclusively on a rival App store. As noted above, when employed by dominant platforms such as Google, MFNs have been recognized as impairing competition.[552] In this case, Google's monopoly power allowed it to enter into contracts precluding developers from offering high-quality exclusive content to rival app stores that might have been used by the app stores to attract a sufficiently large user base and compete more vigorously with the Play Store.[553] In a more competitive environment, developers would have had economic incentives to promote competition in the Android App Distribution market by offering high-quality exclusive content to rival app stores.

228. Pricing-parity MFNs preclude the supplier (developer) from pricing below the price it charges on the platform,[554] but MFNs can also dictate non-price terms such as product quality or timing that indirectly weaken price competition. Baker and Scott Morton explain that "[p]latform MFNs with greater scope and duration would be expected to have stronger anticompetitive effects and impose larger penalties[.]"[555] The scope of Google's equivalent to an

545. GOOG-PLAY-000003283.R at GOOG-PLAY-000003308.R.

546. GOOG-PLAY-000001976 at GOOG-PLAY-000001976-GOOG-PLAY-000001977 ("As [redacted] has influence over a large portfolio of games developers that adds up to [redacted] of Play revenue, [redacted] would have a realistic opportunity to successfully launch an off-Play business which would result in a margin risk of [redacted] for Play." The GVP (Games Velocity Program) deal was designed to "[m]itigate the risk" of [redacted] defection. It included an offer to share revenue (percentage of [redacted] and to [redacted] a percentage of subscription spend into [redacted]

547. GOOG-PLAY-000003283.R at GOOG-PLAY-000003286.R.

548. GOOG-PLAY-003899355.R at GOOG-PLAY-003899360.R.

549. GOOG-PLAY-004146689.R at GOOG-PLAY-004146697.R.

550. *Id.*

551. *Id.* at -722.R.

552. *See, e.g.*, Baker & Morton, *supra.*

553. GOOG-PLAY-000929031 at 032-033.

554. A pricing-parity requirement creates an incentive for the seller not to offer low prices because any price discount must be offered to all covered buyers, which makes discounting more expensive and thus softens price competition. Baker & Morton, *Antitrust Enforcement Against Platform MFNs*, *supra*, at 2179-2180.

555. *Id.* at 2182.

MFN here can be measured by the share of the Play Store's revenue generated by participating Apps among U.S. customers. Using Google's transaction data, I estimate that the 21 developers that were part of Project Hug in 2019[556] accounted for 17.4 percent of all game-related App revenue and 14.6 percent of all App revenue on the Play Store in 2019. I also estimate that the [redacted] game developers that were part of Project Hug and the expanded Games Velocity Program 2.0 in 2020[557] accounted for [redacted] of all game-related App revenue and [redacted] percent of all App revenue on the Play Store in 2020. Put differently, Google's equivalent to an MFN prevented a potential or actual rival App store from preferentially or exclusively selling [redacted] of the most popular applications in 2020.

229. Deposition testimony supports the conclusion that potential competition was eliminated. According to Google's Mr. Koh, the "sim-ship" requirement eliminated one potential avenue of competition from Samsung's Galaxy Store,[558] preventing developers from launching a different version of their games on that App store. For this reason, Mr. Koh "viewed it as it mitigating our risk of losing out to competition" from Samsung and other competitors.[559]

230. Google's sim-ship requirement effectively prevented any rival App store from offering consumers major gaming titles at an earlier date or on an exclusive basis—preferences that could have helped rival App stores to gain a foothold with consumers and convince OEMs to pre-install a rival App store.[560] Once such a new App store was widely distributed, developers could have used that alternative distribution outlet to pressure Google to reduce its take rate in the Android App Distribution Market via the threat of steering. Thus, although the MFN equivalent here was not aimed directly at prices, it ultimately reduced price-based competition by eliminating the prospect of steering.

c. *Google May Have Secured An Agreement To Eliminate Potential Competition from Facebook*

231. As detailed below, I understand that Google may have secured a long-lasting commitment from Facebook not to deploy a competing App store by leveraging the threat of technically disrupting Facebook's updating capabilities. I am not opining on the existence of such an agreement. If the fact finder determines that Google and Facebook did reach such an agreement, it likely would have generated anticompetitive effects.

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556. List taken from GOOG-PLAY-000237798. [redacted] is excluded from this list. GOOG-PLAY-000001976 [redacted] is therefore considering to launch their subscription service in an off-Play Webstore to get the economics they aspire.").

557. The Project Hug developer list was taken from GOOG-PLAY-000237798, with [redacted] excluded, *supra*. The expanded GVP developer list is taken from GOOG-PLAY-004146689.R at -710.R.

558. Koh Dep. 364:9-365:4.

559. *Id.* at 366:2-367:16.

560. Google evaluated the revenue risks associated with various App stores if they decided to compete aggressively, and found that Hug [redacted] GOOG-PLAY-011269238 at -260 (Evaluating the "Yearly Revenue At Risk By 2022" based on whether the [redacted] and other developer stores gain more developers). *See also id*. at -271-276 (outlining various scenarios that each rival App store could pursue).

232. In 2016, Google observed that Facebook was using its preloaded apps on Samsung devices to update its own apps outside the Google Play Store.[561] I understand that this allowed Facebook to have install permissions for first- and third-party apps, meaning it could update and install apps without users receiving Google's unknown sources warning.[562] I also understand that the evidence will show that Google's "Project Wichita" studied Facebook's preloading efforts,[563] and resulted in the development of a feature initially named "Speedbump," and later renamed "VerifiedParent" or "VerifyParent."[564] Facebook complained that this feature disrupted Facebook's ability to update its own apps outside the Play Store by displaying a warning to users.[565] In emails to Google in April 2017, Facebook expressed the concern that Google was trying to sew fear, uncertainty, and doubt ("FUD") in an effort to induce Facebook users "to not accept our installer providing an update to our apps."[566] In a meeting between the companies on May 19, 2017, Facebook requested that Google exempt (or "whitelist") Facebook so that the warning would not be displayed to Facebook users.[567]

233. Google documents and testimony from Kirsten Rasanen, the Google Play Business Development executive responsible for direct management of the Play Store's relationship with [redacted] indicate that, following the May 19, 2017 meeting with [redacted] Google explored offering to whitelist [redacted] in exchange for [redacted] agreeing to limit its direct installation of apps outside the Play Store. [568] The documents suggest that if [redacted] appeared "hostile" to Google's proposal to "not under any circumstances do a direct install of 3p apps" outside the Play Store, then Google would "have a set of things we would do technically to stop this [distribution] from happening - rather than just threaten to pull the [redacted] app from the catalog."[569] A Google executive described this approach as "rolling the nukes up to the border."[570] Testimony from an Executive Vice President at Google, Purnima Kochikar, suggests that [redacted] and Google may have reached an agreement to the effect that [redacted] would not launch a third-party App store in exchange for Google refraining from imposing technical roadblocks involving installation or

561. GOOG-PLAY-007339480.R at -481.R ("Executive Summary" to "Project Wichita" presentation explaining that "Facebook has preloaded at least three Facebook apps on Samsung S7 devices," that "one or more of the apps likely has 'Install_Packages' permission," and that "Facebook is actively using these preloaded apps to install and update the core Facebook App (com.facebook.katana), circumventing Play, in some cases.").

562. *See* Bankhead Dep. 119:7-10 ("Q. Sure. The install permissions allowed Facebook to install third-party apps without getting any type of unknown sources warnings; is that right? A. That sounds correct.").

563. *Id. See also* GOOG-PLAY-003688820.

564. GOOG-PLAY-008216048 (email from Google Play Director of Product Management Paul Gennai explaining that Wichita "later became known as 'Speedbump,'" followed by an email from Kirsten Rasanen, who managed Play's relationship with Facebook, explaining that "Speedbump . . . later became VerifiedParent").

565. GOOG-PLAY-000333091; GOOG-PLAY-007339480.R at -494.R (Project Wichita presentation describing a "technical solution[]" to Facebook self-updating as "[t]hrow[ing] [a] dialogue box . . . if update from source other than the one that drove the install").

566. GOOG-PLAY-004452685 at -685.

567. GOOG-PLAY-000333220 at -221. Record evidence indicates that, at the same meeting, [redacted] disclosed to Google that it was using its preloaded apps to distribute apps outside the Play Store, by enabling users to directly install apps from ads in the [redacted] GOOG-PLAY-004698100.R at -102.R

568. GOOG-PLAY-004698100.R at -105.R ("Potential negotiation: . . . Use Alley-oop for all installs which Play will then update . . . But, we will whitelist you for Verify Parent so you can continue to use your updater to *update* [redacted] apps only."); Rasanen Dep. 110:17-23 ("Q. Is it fair to say that Google explored the idea of white-listing [redacted] for purposes of Speed Bump, VerifyParent, in exchange for [redacted] limiting its direct install activity? . . . THE WITNESS: It is fair to say that that was a negotiation tactic considered.").

569. GOOG-PLAY-000840536.

570. *Id.*

update permissions.[571] Consistent with this, in August 2020, [redacted] executive [redacted] wrote in an email that "[W]e [redacted] have also made verbal commitments to Google to not stand up a competitive App store…This was a way to maintain all of the 1P install and update permissions we wanted to have with the [redacted] installer. While we could change our stance and decide to do 3P App stores, we should expect that Google will respond to maintain their control of App distribution."[572]

234. I understand that Google continued to seek and obtain [redacted] commitment not to compete in subsequent years. According to testimony from Google witnesses and record documents, in 2020 Google signed revenue sharing agreements that would have restricted the ability of some OEMs to preload [redacted] with installation and update permissions. According to this evidence, Google gave [redacted] waivers that allowed it to keep these permissions—but conditioned the waivers on [redacted] continuing to refrain from competing in third-party app distribution.[573]

235. Record evidence indicates that Google offered [redacted] a technology known as "Alley-Oop" to improve the rate at which users installed apps shown in [redacted] Ms. Rasanen testified that "[t]he goal of the [Alley-Oop] product was to -- yes, to make [redacted] want to cease their own distribution efforts."[575] Record evidence indicates that Google initially sought

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571. Kochikar Dep. 406:24-407:18 ("Q. But it's your understanding that [redacted] only had the ability to install first party apps? A. That's my understanding . . . Q. And it's your understanding that there was an executive verbal agreement with [redacted] regarding install and update permissions? A. Yes.").

572. [redacted]_000015003 at -004 [redacted] *See also* GOOG-PLAY-005428116 (email from Play executive Purnima Kochikar to [redacted] *See also* Rasanen Dep. 110:25-111:6 (When asked if Google entered into such an agreement with [redacted] Rasanen testified, "I do not know. I do not know. I don't remember."); [redacted] Dep. 212:8-20 (When asked if [redacted] limited its third-party app distribution efforts in order to preserve the ability to update its own apps, [redacted] Lagerling Dep. 100:3-16 [redacted] and did not "have a lot of recollection around the reasoning internally" related to [redacted] "because at that time my focus was elsewhere."); Lockheimer Dep. 393:4-12 (Google's Hiroshi Lockheimer testified that he had no recollection of discussing [redacted] direct app installs within Google: "Q. . . . Do you recall any discussions at Google with respect to [redacted] experimenting with direct app installs from its [redacted] A. I don't recall. I mean, you're showing me a slide here that references that. You showed me what look like meeting notes that referenced us finding out from [redacted] So I can tell you those two things exist because you showed me those things but other than that, I don't recall.").

573. Kochikar Deb. 425:18-22 ("Q. So at a certain point did [redacted] and Google come to an agreement regarding [redacted] install permissions? A. Yes. [redacted] has agreed, I think, to focus more on the 1P and allow for Google solutions on 3P."); GOOG-PLAY-005428116 (email from Purnima Kochikar to [redacted] stating, in the context of Google giving OEM waivers, that Android leadership had "been working under the assurance that [redacted] has deprioritized/stopped 3P efforts" and asking [redacted] to "confirm that [redacted] is not pursue 3P installs outside of the AlleyOop experiments").

574. GOOG-PLAY-007379918.

575. Rasanen Dep. 169:22-170:3.

to "[k]eep current agreement as is including clause prohibiting 3P APK distribution via any [redacted] apps distributed or updated by Google Play…while offering [redacted] an opportunity to test Alley-oop."[576] When [redacted] refused this offer, Ms. Rasanen wrote that "[w]e will go back to [redacted] and propose a [redacted] trial agreement. . . We will be clear that at the conclusion of the trial period, we will ask for a commitment from them to use Play to distribute all 3P apks in apps that use Alley-oop."[577]

236. Google documents and testimony indicate that it offered Alley-Oop to [redacted] at significant cost to Google's own ad business. In August 2016 email, Paul Bankhead, Senior Director of Product Management for the Play Store, explained, "[T]he question is how best to structure Alley Oop to motivate [redacted] to avoid going down that path [of installing 3P APKs]."[578] Mr. Bankhead compared [redacted] competing in App distribution to "a country who wants to go nuclear,"[579] and proposed that Google "give [redacted] something they want in exchange for slowing or stopping development of their nuclear program."[580] According to Mr. Bankhead Alley Oop was "essentially handing [redacted] billions of dollars of additional ad revenue and hurting [Google's] own ad business."[581]

237. Record evidence suggests that Google leveraged the ongoing negotiations and Alley-Oop trial periods in an attempt to slow [redacted] progress toward competing in App distribution. When negotiating to provide [redacted] with [redacted] on a trial basis in 2016, Google planned to threaten [redacted] with termination of the trial if it "continu[ed] down the path of 3P [app] distribution" during the trial period.[582] [redacted] used Alley-Oop over the course of two trial periods lasting six and nine months.[583] Deposition testimony indicates that [redacted]

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576. GOOG-PLAY-009734977 at -978 ("Proposal: Keep current agreement as is including clause prohibiting 3P APK distribution via any [redacted] apps distributed or updated by Google Play (item 3a) while offering [redacted] an opportunity to test [redacted]

577. GOOG-PLAY-000083999 ("We will go back to [redacted] and propose a [redacted] trial agreement without the apk distribution term, but with rate limited access to the overlay flow with the goal of providing both sides data to understand the efficacy and value of the product. . . . We will be clear that at the conclusion of the trial period, we will ask for a commitment from them to use Play to distribute all 3P apks in apps that use [redacted] GOOG-PLAY-006367390 (June 29, 2017 email from Kirsten Rasanen explaining that [redacted] is "[w]illing to continue testing [redacted] Rasanen Dep. 204:9-16 ("Q. And as contemplated by this e-mail, did you, in fact, make clear to [redacted] that at the conclusion of the trial period, Google would as for a commitment from them to use Play to distribute all third-party APKs and apps that use [redacted] A. I believe I did but I don't recall the specific conversation.").

578. GOOG-PLAY-007379918.

579. *Id.*; *see also* Bankhead Dep. 415:7-9 ("Q So in this analogy, the nuclear power is the ability to install third-party APKs? A Yes.").

580. GOOG-PLAY-007379918.

581. *Id.*

582. *See* GOOG-PLAY-009734977 at -979 ("Verbally signal to [redacted] that our intent is to help create a better user experience and to help them increase ad conversion. If we see that they are continuing down the path of 3P APK distribution, we may terminate this deal.").

583. Rasanen Dep. 151:12-152:3 ("Q. And then picking up on the next sentence, ultimately Google and [redacted] entered into an agreement permitting [redacted] to test Alley-oop for six months; right? A. Yes. Q. And then the agreement was extended for another nine months? A. Yes. Q. And so in total, the agreement was in effect for a year and three months; is that correct? A. Yes. Q. And it's no longer in effect today; is that your understanding? A. That is my understanding. That's my understanding. I don't know if things have changed.").

currently uses Alley-Oop (now called "Last Mile Delivery") for a portion of its Android App installations.[584]

238. For the reasons given above, I conclude that Google's exclusionary Android App Distribution Market Restraints on App Developers were anticompetitive. In a more competitive but-for world, Google would have eliminated these anticompetitive restraints, and the Play Store would have competed on the merits with lower-priced App distribution channels.

4. Technical Barriers

239. I understand that Professor Schmidt finds that Google has imposed technical barriers that make it unnecessarily difficult for consumers to download Apps from rival App stores. I understand that Professor Schmidt explains that, in many cases, users must first locate the store on the Internet, then sideload the store, and then change a security setting on Android devices, which Google discourages by first creating default settings that block these downloads, and then, if the user attempts to change the setting to download an application, by displaying often misleading warnings regarding competing App stores.

240. For example, in 2016 to download the Amazon App store, a user had to complete a series of 19 steps, including selecting "Unknown Sources" within the user's security settings and navigating three separate security warnings.[585] The "Unknown Sources" label is ominous, with early versions warning users that downloading App stores would make your "[p]hone and personal data … more vulnerable to attack."[586] Google has used variations of this warning even for reputable stores like Amazon's.[587] I understand that Google has continued to use such warnings when a user attempts to install rival App stores.[588]

241. Google further frustrates the ability of consumers to customize their devices by imposing technical barriers that impact the downloading of Apps from outside the Google Play Store, including from developer websites. While Google Android technically permits sideloading, I understand that Professor Schmidt opines that Google has made it unnecessarily cumbersome by requiring sideloading to proceed through the "unknown sources" flow. I also understand that Google, over time, has increased the frequency with which a user encounters the "unknown sources" flow. In the past, a user would trigger the "unknown sources" flow when downloading a

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584. Karam Rough Dep. Tr. 179:16-180:1 ("Q. Do you know if [redacted] currently uses a version of AlleyOop? A. I believe they do for a percentage of traffic. Q. And when did AlleyOop rebrand or get a new name to, Last Mile Delivery? A. I am not sure. Q. Do you know if it was in the last – within the last year or so? A. That sounds about – not far off from that is my instinct.").

585. A Google presentation recognized the significance of this sideloading deterrent by documenting the 19 steps required to successfully install Amazon Underground. GOOG-PLAY-000297309.R at -311.R-314.R. I understand that this is confirmed by Professor Schmidt.

586. Blake Stimac, *How to sideload an App onto your Android phone or tablet*, GREENBOT (July 17, 2014), greenbot.com/article/2452614/how-to-sideload-an-app-onto-your-android-phone-or-tablet html.

587. Jimmy Westenberg, *How to install the Amazon Appstore on your Android [Android 201]*, ANDROIDGUYS (Apr. 5, 2014), androidguys.com/tips-tools/install-amazon-app-store-android/.

588. According to one Google document, "App stores generally have relatively low malware install rates[.]" *See* GOOG-PLAY-004904016.R at -4032.R. According to the same document, some of Google's own software, such as Chrome, [redacted] *Id.* (showing, e.g., Chrome with a [redacted] malware install rate, compared with [redacted]

third-party App store, but not when thereafter downloading an App from that third-party App store. Now, a user triggers the "unknown sources" flow when downloading the third-party App store *and* when downloading the user's first app. As a result of these technical impediments, sideloading is not a commercially viable alternative distribution channel for most developers.[589]

242. In addition, I understand that Professor Schmidt will explain that Google has also historically restricted auto-updating capability for Apps not listed in the Play Store or App stores pre-installed by OEMs. (Auto-updating is properly understood as a function in the Android App Distribution Market; there is no separate demand among consumers for that function apart from an App store.) This restriction inhibits competition by degrading the user experience for Apps downloaded from an alternative source. I understand that Professor Schmidt will set forth that Google only recently loosened this restriction when it released Google Android version 12 in October 2021.[590]

243. For the reasons given above, I conclude that Google's unnecessary technical barriers to competitors in the Android App Distribution Market were anticompetitive. In a more competitive but-for world, Google could have eliminated any unnecessary technical barriers, and the Play Store would have competed on the merits.

B. Google's Anticompetitive All-Or-Nothing Bundling of the GMS Suite

244. Google's dominance in the Android App Distribution Market flows in part from its power in the licensed mobile device operating systems market. Indeed, the Android App Distribution Market could be characterized as an aftermarket to the market for licensed mobile device operating systems. Google's documents illustrate how Google's power in the market for licensed mobile device operating systems helps to ensure the Play Store's dominance. A 2019 presentation reviewing the Play Store's business model displays "[t]he 50,000-foot view,"[591] showing Google Android's reach as the first in a chain of factors allowing the Play Store to be monetized.

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589. *See also* Jerry Hildenbrand, *Sideloading and Unknown Sources on Android: How to do it and fix errors*, ANDROID CENTRAL, (Apr. 16, 2020), www.androidcentral.com/unknown-sources ; Edelman & Geradin , *supra*, at 168 ("enabling sideloading requires first reducing phone security settings, which users will rightly hesitate to do."); Joel Snyder, *What are the risks of sideloaded Android applications?*, SAMSUNG KNOX, (Apr. 20, 2020), www.samsungknox.com/en/blog/what-are-the-risks-of-sideloaded-android-applications ; Dallas Thomas, *Get Easy Updates on Sideloaded Android Apps*, GADGET HACKS, (Dec. 27, 2016), android.gadgethacks.com/how-to/get-easy-updates-sideloaded-android-Apps-0174291/.

590. *See also* Google Play services, developer.android.com/distribute/play-services ; GOOG-PLAY-004904016.R.

591. GOOG-PLAY-000443763 at -768.

FIGURE 14: INTERNAL GOOGLE VIEW ON LINKAGE BETWEEN THE PLAY STORE'S DOMINANCE AND ANDROID'S DOMINANCE

Source: GOOG-PLAY-000443763.R at -768.R.

The presentation recognizes that Google's MADAs with OEMs are used to "[t]rade access to Google's Apps for placement;"[592] in other words, Google has leveraged its GMS suite of Apps and APIs to ensure that the Play Store is available and prominently displayed to the user.

245. Google's all-or-nothing bundling of the GMS suite gave it a large competitive advantage as developers were inclined to offer Apps on a platform that was guaranteed to also carry the high-value GMS Apps.[593] Google's Jim Kolotouros testified that he was unaware of any Android smart phone launched outside of China without installing a single Google App or service on the device.[594]

246. Google's all-or-nothing bundling of the GMS suite can be shown to be anticompetitive using standard antitrust methods. A bundled offer can be considered exclusionary provided that an equally efficient competitor in the competitive ("tied") market cannot earn a profit while compensating a buyer for any discounts on the monopolized ("tying") product that the buyer would have to forgo in order to avoid the bundle. This is sometimes referred to as the "discount attribution test," or the *Cascade* test.[595] Applied to this case, the tied product is the Play Store, and

592. *Id*. at GOOG-PLAY-000443769.
593. Edelman & Geradin at 162-164.
594. Jim Kolotouros Dep. 110:13-111:14. Amazon, one of Mr. Kolotouros's exclusions, currently produces only tablets, not smartphones. *Id.* at 125:14-17.
595. *See, e.g.,* Patrick Greenlee, David Reitman, & David Sibley, *An antitrust analysis of bundled loyalty discounts* 26(5) INTERNATIONAL JOURNAL OF INDUSTRIAL ORGANIZATION 1132-1152 (2008); see also Einer Elhauge,

the tying product consists of the high-value GMS Apps that are bundled with the Play Store. If an OEM refuses to install the Play Store on its devices, then it cannot obtain the high-value GMS Apps at any price. Put differently, the "penalty price" of purchasing the tying product outside of the bundle is infinite. It follows immediately that there is no amount of money that a competing App store could offer an OEM that would provide sufficient compensation for the OEM to purchase the high-value GMS Apps on a standalone basis. Therefore, Google's all-or-nothing bundling of the GMS suite is anticompetitive according to the discount-attribution test.

C. Google Has Substantially Foreclosed Competition in the Android App Distribution Market

247. A dominant firm can maintain and extend its monopoly power through strategies that foreclose critical inputs from the competition.[596] This can involve making critical inputs more expensive or even unattainable, as well as restricting the quantity or quality of critical inputs available to rivals. In the Android App Distribution Market, Google has foreclosed competition by has restricting rivals' ability to preload their stores, as explained in Part II.C.1 above. Google has also restricted rivals' access to prominent placement for their App stores, as explained in Part IV.A.2 above. Google has also imposed technical barriers restricting alternative distribution methods for rival App stores and developer websites, as explained in Part IV.A.4 above. In summary, the Challenged Conduct has permitted Google to substantially foreclose competition by denying its rivals access to critical inputs necessary to compete effectively in the Android App distribution market.

248. A dominant firm can also maintain and bolster its monopoly power by paying rivals not to compete with it.[597] As explained in Part IV.A.1 above, Google did exactly that through its revenue-sharing agreements with carriers, which inhibited competition not just from the carriers themselves, but also from OEMs and third-party app stores.

249. In addition to foreclosing competition in the In-App Aftermarket, the Aftermarket Tie-In served to reinforce foreclosure in the Android App Distribution Market. Record evidence indicates Google recognized the potential for would-be rivals to [redacted] Economists recognize the importance of this "two-stage entry" in digital markets.[599] The Aftermarket Tie-In foreclosed this pathway to increased competition.

Tying, Bundled Discounts and the Death of Single Monopoly Profit Theory, 123(2) HARVARD LAW REV. 397-481 (2009).

596. *See, e.g.,* Steven Salop, *The Raising Rivals' Cost Foreclosure Paradigm, Conditional Pricing Practices, and the Flawed Incremental Price-Cost Test* 81(2) ANTITRUST LAW JOURNAL 371 (2017). *See also* Kevin Caves, Chris Holt, & Hal Singer, *Vertical Integration in Multichannel Television Markets: A Study of Regional Sports Networks* 12(1) REVIEW OF NETWORK ECONOMICS 61 (2013).

597. *See, e.g.,* Steven Salop, *The Raising Rivals' Cost Foreclosure Paradigm, Conditional Pricing Practices, and the Flawed Incremental Price-Cost Test* 81(2) ANTITRUST LAW JOURNAL 371, 379 (2017).

598. GOOG-PLAY-006829073.R at -153.R.

599. Michael Katz & Carl Shapiro, *Antitrust in Software Markets,* in JEFFREY EISENACH & THOMAS LENARD, EDS. COMPETITION, INNOVATION, AND THE MICROSOFT MONOPOLY: ANTITRUST IN THE DIGITAL MARKETPLACE 29, 70-71 (Springer Dordrecht 1999).

[redacted]

250. In this Part, I demonstrate that Google has engaged in anticompetitive conduct to extend and retain its power in the In-App Aftermarket. For the reasons given below, I conclude that the Aftermarket Restrictions function as an anticompetitive tie-in of Google's Android App Distribution Market services to the In-App Aftermarket. In a more competitive but-for world, Google would have refrained from tying, and would have competed on the merits with rivals in the In-App Aftermarket.

A. Google's Anticompetitive Exclusionary Conduct in the In-App Aftermarket

251. Google has maintained multiple restrictions affecting the In-App Aftermarket. These fall into three mutually reinforcing categories. By contract, Google conditions the right to distribute an App downloaded through the Play Store on a developer's agreement to exclusively use Google Play Billing for all subsequent sales of In-App Content.[600] Google contractually requires developers to pay Google a set take rate (generally at 30 percent) for every purchase of In-App Content made through their Apps in perpetuity.[601] Put differently, Google enforces this condition by requiring the developer to use Google Play Billing for all payments of In-App Content

600. Google – Play Console Help, *Developer Program Policy* (effective December 1, 2021), support.google.com/googleplay/android-developer/answer/11498144?hl=en&visit_id=637814760589469507-2803788482&rd=1. https://support.google.com/googleplay/android-developer/answer/11365487?hl=en. *See also* my discussion earlier in Part III.C.

601. Record evidence indicates that Google recognized that its decision to reduce its take rate to 15 percent after one year for subscription developers was justified because the Play Store's contribution to value declines after the initial download. Paul Feng Dep. 329:13-331:18 (discussing GOOG-PLAY-000571076.R).

within the App forever and at the same take rate it commands in the Android App Distribution Market.[602] If a consumer downloads an App via the Play Store, the developer is charged a commission for any purchases made within the App, even long after the Play Store performed its initial matchmaking and distribution function. Thus, Google has extended its monopoly power in the Android App Distribution Market to insert itself into the separate In-App Aftermarket by requiring developers to exclusively use Google Play Billing for authorization and payment services in support of the purchase of In-App Content and to pay Google a take rate on those purchases (usually 30 percent), which can economically be characterized as a "tie-in."

252. Google also contractually prohibits developers from steering customers to alternative authorization and payment processing outlets for purchasing In-App Content outside the Play Store, including the developer's web site or alternative suppliers of payment processing and other services in the In-App Aftermarket.[603] And Google even prohibits the developer from using any consumer information learned through the Play Store. These restraints constrain an App's steering to lower-cost alternatives via browser-based payment options such as "in-App web views, buttons, links, messaging, advertisements, or other calls to action."[604]

253. In contrast, other App stores allow developers the ability to select their providers of payment systems for purchases of In-App Content at lower take rates than Google imposes. For example, Aptoide imposes a ten percent take rate for purchases of In-App Content if the user downloads the App using the developer's own URL.[605] The One Store in South Korea imposes a five percent commission for developers that do not use the One Store billing system.[606]

1. Google's Contractual Provisions with Developers Enable Google To Maintain Its Dominance in the In-App Aftermarket

254. In other settings, the long-term or perpetual arrangements that Google has imposed on developers might have been difficult to enforce. That is not the case here. By requiring developers to use Google Play Billing in support of the purchase of all In-App Content, Google can readily monitor and enforce its take rates, enabling extraction of a supra-competitive commission for as long as the App is used and In-App Content is purchased.

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602. *See* Google - Play Console Help, *Service fees*, support.google.com/googleplay/android-developer/answer/112622?hl=en. The service fee applies if developers sell subscriptions or other digital content within an app, but is not affected by the length of time after an App is downloaded – with the exception of subscription products, which face a lower service fee after being retained for over a year.

603. Play Console Help – Policy Center, *Payments*, ¶4 support.google.com/googleplay/android-developer/answer/9858738?visit_id=637998221375662867-914435124&rd=1. *See also* GOOG-PLAY-000225435 ("[I]t's against policy to direct users to content outside of the Play Store (including to 3rd party websites offering rewards).").

604. Play Console Help – Policy Center, *Payments*, ¶4 support.google.com/googleplay/android-developer/answer/9858738?visit_id=637998221375662867-914435124&rd=1.

605. Catappult, Revenue share, docs.catappult.io/docs/distribution-and-revenue-share ("Self-distribution opens the possibility for the developer to promote and distribute their Apps through their own channels and earn a revenue share of 90%").

606. GOOG-PLAY-000005203 at -5221, -5264. *See also* Kim Byung-wook, *Google's App billing plan continues to backfire*, THE KOREA HERALD (June 28, 2021), koreaherald.com/view.php?ud=20210628000824 ("Unlike Google, ONE store allows App developers to operate their own billing systems. In this case, the cut is 5 percent.").

255. Only about three percent of the developers that sold In-App Content in the In-App Aftermarket through Apps initially downloaded from the Play Store in 2020 were able to circumvent the restriction, although Google later announced that it was going to enforce the restriction on this group.[607] Those few developers able to circumvent Google's restrictions have a critical mass of consumers and widespread name recognition, which has enabled them to allow users to purchase their In-App Content from other platforms. The most prominent developers in this category are Netflix, Amazon, Spotify, and Match Group.[608] A company like Netflix, a household name with over 200 million subscribers, does not want to hand over to Google 30 percent of first-year subscriber revenue simply because a consumer created her account on her Android App. Circumventors like Netflix were able to steer users to their websites, where consumers could create a new account not subject to Google Play Billing.[609] Developers engaging in this steering had to do so indirectly—through communications outside the App—because Google's agreements with developers preclude them from explicitly steering users to the developer's website for digital content purchases.[610] The vast majority of developers do not possess the requisite widespread user adoption, name recognition, and clout to circumvent Google's restriction.

2. Google's Revenue-Sharing Agreements with Developers Have Substantially Eliminated the Threat of Defection to Alternatives in the In-App Aftermarket

256. Google has taken steps to rein in any developers whom it perceived might threaten to use alternative authorization and billing systems in the In-App Aftermarket to avoid Google's take rate.

257. Initially, Google limited Project Hug (described in Part IVA.3.b above) to the 21 highest-grossing game developers—ostensibly to provide "increased value to both Google and

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607. Samat , *Listening to Developer Feedback to Improve Google Play*, *supra.*

608. EPIC_GOOGLE_00123016; EPIC_GOOGLE_01389946. Google still holds significant power over these companies. For instance, Match Group's chief legal officer, Jared Sine, in testimony before the United States Senate detailed communications from Google inquiring into why his testimony might differ from what they had already discussed. "When you receive something like that, Senator, from a company that can turn you off overnight, you're always a little intimidated," said Sine. He added, "We're all afraid, is the reality, Senator." Angel Au-Yeung, *App Providers Are 'All Afraid' Of Apple's And Google's Market Power, Match Group And Spotify Tell Senate*, FORBES (Apr. 21, 2021), forbes.com/sites/angelauyeung/2021/04/21/app-providers-are-all-afraid-of-apples-and-googles-market-power-match-group-and-spotify-tell-senate/?sh=4a622ae9596c. *See also* GOOG-PLAY-000559379.R at -382.R ("We have found that, in gaming, the concerns over revenue share predominantly come from the largest players who have built significant businesses and are now focused on improving margins.").

609. Tinder also accomplished steering by means of differential pricing—offering significantly lower prices for its subscription services when users signed up through its website. EPIC_GOOGLE_02075797 ("The Tinder App charges $29.99 a month for a Gold membership (which shows you everyone who's swiped right on you). Tinder's website charges just $13.49 a month for the same service.").

610. When Epic explicitly steered consumers to their own payment system rather than Google's system by providing a 20% discount, Google removed Epic's Fortnite from the Play Store. *See* Jack Nicas, *How Apple's 30% App Store Cut Became a Boon and a Headache*, NEW YORK TIMES (Aug. 14, 2020), nytimes.com/2020/08/14/technology/apple-app-store-epic-games-fortnite.html. Google states that developers are allowed to use other platforms in addition to Google Play, but that they cannot directly advertise alternative options through their App. *See* Google - Play Console Help, *Understanding Google Play's Payments policy*, support.google.com/googleplay/android-developer/answer/10281818?hl=en#zippy=%2Ccan-i-distribute-my-app-via-other-android-app-stores-or-through-my-website%2Ccan-i-communicate-with-my-users-about-alternative-ways-to-pay%2Ccan-i-communicate-with-my-users-about-promotions-on-other-platforms.

developers while easing developer agitation about Google Play's revenue share."[611] Google chose these developers because "[t]hey also often have their own billing solutions and are therefore capable of going off Play billing if there's an industry shift."[612] Indeed, Google estimated that defection by these developers could cost Google [redacted] *revenue* / [redacted] *margin* impact annually in three years [redacted] revenue /[redacted] margin risk cumulative 2019-2022)."[613] Google estimated the cost of risk mitigation through Project Hug payments at only [redacted] through 2022.[614] Although the primary purpose of Project Hug was to prevent developers from supporting a rival App store, a secondary purpose was to prevent an alternative form of payment processing in the In-App Aftermarket from taking root.

258. Depositions to date have confirmed the success of Project Hug in foreclosing competition. When one of the key employees at Google in charge of Project Hug left Google in 2020, he assessed that [redacted]

259. Google also introduced a variety of "Velocity" programs, aimed at inducing other powerful developers to comply with its Google Play Billing restrictions, including: (1) the LRAP, which focused on live TV and video Apps; (2) ADAP, which focused on music Apps; and (3) AVP, a generalized Project Hug-for-Apps program for high-priority partners that did not fit into any of the other categories.[616] While the ostensible purpose of the LRAP and ADAP programs was to accommodate "constrained dev margins," the AVP's goal was, like Project Hug, to "boost integration with Play Billing" by offering to "reinvest [redacted]

B. Google Substantially Foreclosed Competition in the In-App Aftermarket

1. Google's Aftermarket Tie-In Substantially Foreclosed Competition In the In-App Aftermarket

260. The Aftermarket Tie-In has substantially foreclosed competition in the In-App Aftermarket. Before Google offered In-App Aftermarket services, other companies provided these services for Android apps. In June 2010, a mobile payments startup called Boku announced it would be offering developers the capability "to monetize any Android app with in-app purchases via carrier billing."[618] PayPal introduced a "library for Android developers to use to integrate

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611. *See* GOOG-PLAY-000559379.R at -382.R ("Thus far we have avoided altering our revenue share business model and instead have engaged this limited set of game developers (21 devs) in cross-Google commercial deals to both build deeper relationships with these partners and reduce agitation around our 30% revenue share."). *See also* Koh Dep. 153:10-19 (Project Hug targeted developers that Google projected would constitute [redacted] of overall Play Store consumer spend in 2019) (testifying about PX. 136 – GOOG-PLAY-003332817.R at -822.R).

612. GOOG-PLAY-000233314

613. GOOG-PLAY-000000807

614. *See* GOOG-PLAY-000004762.R at -764.R.

615. Koh Dep. at 368:4-369:4.

616. GOOG-PLAY-004144047.R at -052.R (explaining this program would only be available to those developers who represented [redacted]

617. GOOG-PLAY-003881390.R.

618. Leena Rao, *Mobile Payments Startup Boku Launches In-App Billing Library For Android*, TECH CRUNCH (June 2, 2010), techcrunch.com/2010/06/02/mobile-payments-startup-boku-launches-in-app-billing-library-for-android/

Paypal payments into their app" in May 2010.[619] When Google began to offer In-App Aftermarket services, Google employees discussed "how we will 'transition' apps using other in-app payments systems to our [in-app billing] service."[620] This "transition" involved forcing developers to stop doing business with In-App Aftermarket rivals in order to avoid being removed from Android Market.[621]

261. The Aftermarket Tie-In substantially foreclosed these would-be rivals from competing in the In-App Aftermarket. In September 2020, Google reported that only about three percent of developers in the Play Store had used payment processors other than Google Play Billing in the prior year.[622] Google's enforcement of the In-App Aftermarket Tie-In requires developers to use only Google Play Billing for all purchases of In-App Content. Developers are prevented from using their own methods of authorization and payment processing services or contracting for them through third parties. Alternative providers are therefore foreclosed from the In-App Aftermarket. Google's documents indicate that the Aftermarket Tie-In served to protect it from substantial competition from various potential entrants, such as Facebook, Amazon, Epic, Samsung, and Stripe.[623]

262. Record evidence indicates that Google recognized that the Aftermarket Tie-In was necessary to prevent developers from threating to switch to a competing In-App Aftermarket rival as a tactic for negotiating a lower take rate. As Google executive Sameer Samat observed, "Unless we fix the [Google Play Billing] policy issue this stuff is going to continue. Anyone who can hold the choice out over our heads will negotiate on price because why not."[624] Record evidence also indicates that Google recognizes that, in the absence of the Aftermarket Tie-In, lower-cost competitors would enter the market. One Google presentation explains that making Google Play Billing "non-exclusive" and "allow[ing] 3d party payments," would involve s [redacted]

263. Although fringe rivals such as Samsung and Amazon participate in the In-App Aftermarket today, their market shares are minimal, as shown in Part III.C.2.a above. The existence of these fringe competitors does not negate Google's substantial foreclosure of the In-App Aftermarket. Developers that distribute their Apps through the Play Store cannot turn to fringe rivals such as Samsung and Amazon as competitive alternatives in the In-App Aftermarket.

264. The ability of a small number of large developers such as Netflix and Spotify to circumvent the Aftermarket Tie-In by using their own payments systems does not negate Google's

619. Greg Kumparak, *PayPal launches In-App Payment library for Android*, TECH CRUNCH (May 19, 2010), techcrunch.com/2010/05/19/paypal-launches-in-app-payment-library-for-android/.

620. GOOG-PLAY-004320094.

621. *Id.* ("Specifically, for apps that use an in-app system that violates the DDA, it might be better to reach out with a warning, giving them a limited period of time to move to IAB before there's a takedown. . . . Once the service is more widely known and implemented, I think the warning period could be reduced or eliminated altogether."). Google also noted that if it eliminated the tie-in, "Apple could offer a billing alternative on Android." *Id.*

622. *See* Samat, *Listening to Developer Feedback to Improve Google Play*, *supra* ("Less than 3% of developers with apps on Play sold digital goods over the last 12 months, and of this 3%, the vast majority (nearly 97%) already use Google Play's billing.").

623. GOOG-PLAY-006829073.R at -159.R.

624. GOOG-PLAY-009911010 at -011.

625. GOOG-PLAY-000565541.R at -560.R.

substantial foreclosure of the In-App Aftermarket. The vast majority of developers in the Play Store cannot avail themselves of this option and are obliged to comply with the In-App Aftermarket Tie-In. In addition, because developers such as Netflix and Spotify use their own vertically integrated payment solutions, they do not provide an opportunity for third-party rivals to compete in the In-App Aftermarket.

2. Google's Aftermarket Tie-In Foreclosed Competition From Online Stores

265. Google has also used the Aftermarket Tie-In to foreclose online stores offering In-App Content, an alternative distribution channel that could have threatened Google's dominance in the In-App Aftermarket. In 2015, popular Apps such as LINE and Kakao, were enabling users to make In-App purchases of virtual currency and other digital goods through online stores.[626] These online stores offered users the ability to pay with multiple forms of payment, some of which could not be used with Google Play Billing, including PayPal, prepaid internet café cards, and gift cards.[627] To incentivize consumers to utilize this alternative distribution channel, developers offered discounts on In-App Content purchased through online stores.[628] For example, LINE offered web store buyers 30 percent more content for the same price,[629] as well as 25 percent in bonus credit for customers utilizing the company's own payments system ("LINE Pay)."[630]

266. Google characterized this alternative distribution channel as "stealing" "high value users" through "discounts they provide through their own channel."[631] In a slide titled "Arguments for and against allowing web stores," the first "Argument[] against" Google listed was, "Huge loss of revenue."[632] Google estimated that it could lose between $1 billion and $2 billion in consumer expenditure to web stores in the Asia-Pacific region alone.[633] Separately, Google estimated that allowing online stores to compete in the In-App Aftermarket would cost Google approximately $1.2 billion in annual consumer spend through Google Play Billing.[634] Google took steps to eliminate the risk web stores posed to Play's business. According to Google's documents, possible measures included "official warning[s]" to developers, with the option to then move into "Refrain[ing] from featuring on [the] app store . . . globally," "Decreas[ing] rank in Play search results and Top Charts," "Block[ing] minor app(s) of developer," "Block[ing] everything temporarily on app store," and then potentially "Block[ing] everything for an extended period (e.g. 3 months) on Play Store."[635]

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626. GOOG-PLAY-000447326.R at -369.R.

627. GOOG-PLAY-002410316.R at -333.R; *see also* GOOG-PLAY-011097069 ("Example: in Japan, a user can walk into a convenience store, buy a physical LINE gift card, then on phone/PC browser, inputs the serial code from the gift card on the LINE web store, receiving LINE credit. The credit can then be used to buy on the LINE web store e.g. an in-app item for a specific game that was downloaded from Play on Android.").

628. GOOG-PLAY-002410316.R at -338.R (showing "5% better value on web store").

629. *Id.* at -339.R.

630. GOOG-PLAY-011097069 at -082.

631. GOOG-PLAY-007280720 at -720.

632. GOOG-PLAY-002410316.R at -340.R.

633. *Id.* at -341.R.

634. GOOG-PLAY-011097069 at -071. Google described the impact on consumer spend through Play as "Disastrous." *Id.*

635. GOOG-PLAY-011097069 at -075-76.

267. Although it is unclear which of these particular measures were undertaken with specific developers, according to Google's documents, it began "send[ing] warnings to developers" engaged in web store sales, which evidently "deterred this behavior."[636] According to Google's documents, Google determined it had "partially stopped" web stores "by BD"—or business development efforts.[637] Record evidence indicates that a least one large developer, [redacted] resisted Google's efforts to foreclose its online store.[638] Nevertheless, [redacted] took steps to limit the use of its online store, ultimately removing links in its App to its outside web store in response to Google.[639] Google also refused to allow [redacted] a major mobile game developer with [redacted] in annual consumer expenditures on Play, from offering its users an online store.[640] Google also refused to allow [redacted] to offer users the ability to use gift cards to purchase In-App Content.[641] Google also prevented Korean developer [redacted] with [redacted] in annual consumer spend on Play, from allowing the purchase of In-App Content using a Korean gift certificate.[642] According to Google documents, this "[s]et an example for other developers."[643]

268. Google's enforcement of its In-App Aftermarket Tie restricted consumer access to payment alternatives and limited consumer choice. According to Google documents, online stores offered users discounts and access to local forms of payment.[644] For example, Gamevil processed "30% additional transactions through third-party payments" outside Play; those payments were made predominantly using gift certificates "by teens that do not have credit cards;" Google prevented Gamevil from accepting this form of payment from teenaged users.[645] In addition, the availability of in-game currencies and items in online stores enabled users to purchase digital goods in a single location, and to use them across different devices. By preventing steering and the embedding of these alternative payment methods in-app, Google restricted users' ability to access better prices and forms of payment.[646]

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636. GOOG-PLAY-000890941 at -943; *see also* GOOG-PLAY-011097069 at -075 ("Ask nicely for devs to comply (with an official warning) (it's possible to enforce and discourage certain behaviors without changing language; say 'this is how we interpret it'). . . . Actually often worked in the past.").

637. GOOG-PLAY-002410316.R at -321.R.

638. *Id.*

639. GOOG-PLAY-000871962 at -962-963 (July 31, 2017 email from Google's Kevin Wang to Chongsa Kim, in which Wang observes, "Looks like Line app does not include any links from their app to the webstore thanks to your BD efforts," and Kim replies, "Yes, we managed removing such links from their mobile apps/games.").

640. GOOG-PLAY-011097069 at -080 ("Early 2014, [Gungho] asked if they could use web store, BD team said no it's gray zone, therefore they stopped.").

641. *Id.* at -081 ("Kakao tried to launch Kakao gift card but Play team advised that it would not be 100% compliant to Play policy and they gave up the plan…Considering that LINE gift card sales in JP is over $30mn / quarter (est.) this could have been significant, esp. since spend on Kakao games in KR is similar to spend on LINE games in JP.").

642. *Id.*

643. *Id.*

644. One employee asked in a discussion of policy enforcement with respect to web stores, "do 3PP [third-party payments]/web-stores always offer significantly discounted IAPs or does it offer more locally friendly FOPs or both?" GOOG-PLAY-006753434.

645. GOOG-PLAY-011097069 at -081.

646. Google documents indicate that users were not typically visiting the online stores to purchase the items, as opposed to linking to the online stores from within the Apps. *See* GOOG-PLAY-002410316.R at -347.R.

269. Record evidence indicates that the economic effects of Google's efforts to foreclose online stores were substantial. Google estimated that "hundreds of millions (USD) in annual spend already saved through pressuring devs/publishers to reduce payment circumvention."[647]

C. Google Cannot Claim That Its Supracompetitive Profits Are Constrained by the "Single Monopoly Profit" Theory

270. Economists recognize that tying allows firms to extract more consumer surplus than they could otherwise, and can be anticompetitive when practiced by firms with market power.[648] In the 1970s and 1980s, economists belonging to the "Chicago School" of economics—which promotes the virtues of free-market principles[649]—condoned many exclusionary strategies with an economic theory that has become known as the "single monopoly profit" ("SMP") theory. The SMP theory posits that, since a monopolist will always find a way to fully exploit its monopoly profit in the market it has monopolized, regardless of the existence of a secondary market or aftermarket, any exclusionary conduct in the secondary market is motivated by procompetitive reasons, such as vertical integration efficiencies, and should not be condemned as anticompetitive.[650]

271. Applied to this case, Google may erroneously argue that the SMP theory could be interpreted to deem Google's Aftermarket Restrictions procompetitive and lacking in harm to competition or consumers. It would posit that, if Google were prohibited from engaging in the Challenged Conduct, Google would merely raise its take rate in the Android App Distribution Market or impose some other fees to fully restore the profits it now extracts from the In-App Aftermarket. SMP theory suggests that, so long as Google had a monopoly in the Android App Distribution Market, it would find a way to fully extract a monopoly profit from that market, such that there would be no incentive to further monopolize the In-App Aftermarket. In this section, I explain how two of the key assumptions that undergird the SMP theory are not satisfied, meaning that the profits Google has extracted from the In-App Aftermarket were not available to Google solely on the basis of its monopoly in the Android App Distribution Market. Accordingly, Google's anticompetitive conduct in the In-App Aftermarket was motivated to extract incremental supra-competitive monopoly profit from developers.

272. A wave of new economic research in the 1990s and 2000s has shown that the implications of the SMP theory hold only if certain assumptions that underlie it also are true.[651] As it is applied to artificially linking a monopolized service—here, Android App distribution—with

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647. GOOG-PLAY-007348629.R at -640.R.

648. *See, e.g.,* Michael Whinston, *Tying, Foreclosure, and Exclusion* 80(4) AMERICAN ECONOMIC REVIEW 837-859 (1990); Ilya Segal & Michael Whinston, *Naked Exclusion: Comment* 90(1) AMERICAN ECONOMIC REVIEW 296-309 (2000); Einer Elhauge, *Tying, Bundled Discounts and the Death of Single Monopoly Profit Theory*, 123(2) HARVARD LAW REV. 397-481 (2009); JEFFERY CHURCH & ROGER WARE, INDUSTRIAL ORGANIZATION: A STRATEGIC APPROACH, 159 (McGraw-Hill 2000).

649. Akhilesh Ganti, *Chicago School of Economics*, INVESTOPEDIA (Feb. 21, 2021), www.investopedia.com/terms/c/chicago_school.asp.

650. *See, e.g.*, Robert Bork, THE ANTITRUST PARADOX: A POLICY AT WAR WITH ITSELF (Bork Publishing 2021); Aaron Director & Edward H. Levi, *Law and the Future Trade Regulation,* 51 NW. U. L. REV. 281 (1956).

651. For a review of the economic literature, see Einer Elhauge, *Tying, Bundled Discounts and the Death of Single Monopoly Profit Theory*, 123(2) HARVARD LAW REV. 397-481 (2009).

a product or service in another market—here, services in support of the purchase of In-App Content—the five conditions under which the SMP theory holds are:

(1) buyers do not use varying amounts of the linked product or service (in the In-App Aftermarket);

(2) buyers exhibit a strong positive correlation in their demands for the linked product or service (in the In-App Aftermarket) and the linking products or services (in the Android App Distribution Market);

(3) buyers do not use varying amounts of the linking product or service (Android App distribution);

(4) the competitiveness of the linked market (the In-App Aftermarket) is fixed; and

(5) the competitiveness of the linking market (the Android App Distribution Market) is fixed.[652]

273. When any one of these assumptions is not supported empirically, then the pro-competitive justifications of SMP theory do not hold.[653] Here, assumptions (1) and (4) are not satisfied. Failure to satisfy either one would undermine application of SMP theory. Failure to satisfy both assumptions strengthens that conclusion. Because SMP theory does not apply here, Google is using its Aftermarket Restrictions to extract profits it otherwise would not be able to obtain. The inapplicability of SMP theory implies an anticompetitive motivation for Google's Aftermarket Restrictions.

274. Google's take rate in the In-App Aftermarket is tethered to the spending on In-App Content by the consumer. The demand for the services in support of consummating the purchase of In-App Content is derived from the demand for the In-App Content itself. Applied to this case, for Google to extract consumer surplus solely by virtue of its market power in the Android App Distribution Market, assumption (1) requires that consumers do not purchase varying amounts of In-App Content. This is plainly false. Different consumers purchase different quantities of In-App Content, and therefore Google's revenues through its take rate anticompetitively applied to those purchases vary by consumer. This is evident from my examination of Google's transaction database. Figures 16, 17, and 18 show the distributions of purchases of In-App Content for three of the top-selling games.

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652. *Id*. at 404 ("However, the model indicating a single monopoly profit *depended on several key assumptions*: (1) fixed usage of the tied product; (2) strong positive demand correlation; (3) fixed usage of the tying product; (4) fixed tied market competitiveness; and (5) fixed tying market competitiveness. As the economic literature shows, different results are reached if one relaxes these narrow assumptions. Indeed, relaxation of any one of these assumptions produces a distinctive profit increasing effect.") (emphasis added).

653. *Id*. For example, when assumption (1) is violated and consumers use varying amounts of the linked product or service, tying can be used to extract consumer surplus, with buyers who use more of the tied product effectively paying more for the same product. Discriminating with ties may be more effective than traditional price discrimination—that is, charging a different price to each buyer—if the firm could not otherwise tell how much buyers value the tying product.

FIGURE 16: IN-APP PURCHASES PER USER [redacted]

[redacted]

[redacted]

[redacted]

FIGURE 18: IN-APP PURCHASES PER USER [redacted] [redacted] [redacted]

[redacted]

275. As the figures demonstrate, the consumers' purchases of In-App Content vary widely across buyers, proving that assumption (1) is violated. The varying amounts of purchases of In-App Content provides an anticompetitive motivation for Google's extension of its monopoly power in the Android App Distribution Market into the In-App Aftermarket to extract more revenue from its monopoly position—an opportunity that would not exist in the absence of the Aftermarket Restrictions.

276. Google may argue that it inserted itself into the In-App Aftermarket via the restraint requiring developers to use Google Play Billing for all transactions so as to monitor and "meter" both a customer's usage and a developer's sales of In-App Content for an App. However, as a matter of economics, Google cannot extract the same level of monopoly profits through this restriction as it would solely through a monopoly in the Android App Distribution Market. Given the wide range of purchases of In-App Content, it would be very difficult for Google to predict, *ex ante*, a given consumer's propensity to make particular purchases of In-App Content. Such a prediction would be needed by Google to replicate a metering strategy with upfront pricing for Apps sold solely in the Android App Distribution Market through the Play Store.[654] The problem

654. A "metering tie" occurs whenever a firm meters usage of its product by requiring users to purchase at elevated prices a tied product that is needed to use its product, as in the case of printers and ink. Economists have shown that, contrary to the Chicago School, metering ties are often used for anticompetitive purposes. *See, e.g.*, Einer Elhauge & Barry Nalebuff, *The Welfare Effects of Metering Ties*, 33 JOURNAL OF LAW, ECONOMICS & ORGANIZATION 68 (2017) (showing that metering ties (1) *always* lower consumer welfare and total welfare unless they increase capital good output, and (2) *always* harm consumer welfare, even when output increases, under realistic market conditions in which usage rates are independently distributed from per-usage valuations). Applied here, there is no credible theory under which Google's restrictions increased output in the Android App Distribution Market. Indeed, to the extent a foreclosed rival in the In-App Aftermarket could have evolved into a competitive App store, Google's restrictions could have reduced output in the Android App Distribution Market as well. *See, e.g.*, GOOG-PLAY-004564758 (noting that "preventing payment circumvention" from in-App purchases could reduce the possibility that a nascent competitor in the In-App Aftermarket would expand to be a full-bore App store competitor in the adjacent Android App Distribution Market).

for Google is that it is impossible to know *ex ante* how much any given consumer/developer combination will use an App and subsequently generate any purchases of In-App Content so as to be able to price Apps to generate a supra-competitive monopoly profit for Google.

277. In addition to assumption (1) being violated, assumption (4) requires that the "competitiveness" of the In-App Aftermarket be "fixed"—that is, the tied market is perfectly competitive in a way that tying cannot alter. Applied here, that would mean that In-App Aftermarket rivals (such as independent payment processors or developers) face no entry or fixed costs and can expand instantaneously to supply the whole market.[655] If true, then the extent of competition in the In-App Aftermarket would be invariant to Google's tie-in, in the sense that Google's inserting its payment processing service into the In-App Aftermarket cannot be used to reduce the competitiveness or efficiency of rivals or potential rivals in the In-App Aftermarket.[656] This assumption is not true, however, because Google's contractual linkage is specifically designed to prohibit developers from using any alternative to Google Play Billing to provide In-App Aftermarket services. In the absence of the requirement, there would be myriad third-party providers of In-App Aftermarket services (such as payment processing, authorizing the use of In-App Content, record keeping, and server hosting) for developers, which would engender competition on take rates.

278. Moreover, the infrastructure to provide payment processing (and authorization) exhibits economies of scale;[657] the same payment system (or record-keeping system or server) can be used for each additional transaction. Depriving third-party competitors in the In-App Aftermarket of scale economies makes them weaker competitors and alters the state of competitiveness in the In-App Aftermarket. Google's tie-in can foreclose enough of the tied market to make entry revenues, spread across a lower base of transactions, lower than entry costs. Just as a monopoly resort that requires guests to eat all meals on the property (a tie-in) can foreclose independent local restaurants and prevent them from achieving the requisite economies of scale,[658] so too has Google foreclosed rival suppliers in the In-App Aftermarket, resulting in the ability for Google to charge supra-competitive take rates on purchases of In-App Content. In an open, competitive In-App Aftermarket, developers would be free to choose an alternative payment processor, and take rates in the In-App Aftermarket would fall towards competitive levels. In the

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655. Einer Elhauge, *Tying, Bundled Discounts, and the Death of the Single Monopoly Profit Theory*, 123(2) HARVARD LAW REVIEW 397-481, 413 (2009).

656. *Id.* ("the economic literature summarized below shows that a tie that forecloses enough of the tied market can reduce rival competitiveness by impairing rival efficiency, entry, existence, aggressiveness, or expandability.").

657. *See, e.g.*, Oxera, *Paying up: the new economics of payment systems* (Jun. 30, 2020), www.oxera.com/insights/agenda/articles/paying-up-the-new-economics-of-payment-systems/ ("Retail payments have long been characterised by the following three economic features …. economies of scale—which mean that it can be more efficient to operate a platform with a large number of users (although regulatory and technical developments are tending to reduce the importance of this)."); Risto Gogoski*, Payment systems in economy - present end future tendencies*, 44 PROCEDIA - SOCIAL AND BEHAVIORAL SCIENCES 436–445, 438 (2012) ("The payment industry also exhibits considerable economies of scale. First, the value that an individual participant derives from using a particular payment system increases with the number of other parties using that same system. Second, high levels of initial investment (called 'sunk costs') are required in order to establish a payment system, and considerable fixed costs are incurred in the operation of such a system (more payments less costs).").

658. This example comes from Dennis Carlton, *A General Analysis of Exclusionary Conduct and Refusal to Deal—Why* Aspen *and* Kodak *Are Misguided*, 68(3) ANTITRUST LAW JOURNAL 659-983 (2001).

next section, I offer two models that can be used to estimate those reduced take rates in the Android App Distribution Market and in the In-App Aftermarket, respectively.

VI. THE CHALLENGED CONDUCT GENERATED ANTITRUST IMPACT

279. A key difference in the two relevant antitrust markets—the Android App Distribution Market being two-sided and the In-App Aftermarket being one-sided—allows for different methods for assessing impact or what take rates and consumer subsidies would prevail in each market without Google's Challenged Conduct. I discuss these two methods and their implications in turn. In Part VI.B, using a two-sided model developed by Rochet and Tirole, where the locus of competition is on the developer take rate, I show classwide impact for those members of the Damages Class in the Android App Distribution Market. In Part VI.C., using a one-sided model of price competition, I show classwide impact for members of the Damages Class in the In-App Aftermarket. In Part VI.E, again using the two-sided model developed by Rochet and Tirole, where the locus of competition is instead on the consumer subsidy, I show classwide impact for members of the Damages Class. In Part VII, I estimate aggregated damages to U.S. Consumers nationwide based on these impact models. In Part VIII, I describe a methodology for computing individual U.S. Consumers' damages.

280. My analysis differs from the standard regression analysis commonly used in many price-fixing matters to isolate the effects of anticompetitive conduct in a limited timeframe compared to a competitive market absent the challenged restraints. Because Google has imposed the Challenged Conduct in both the Android App Distribution Market and the In-App Aftermarket since those markets were originally formed, there is no pre-existing or post-conduct time period to use for purposes of standard regression analysis. Accordingly, I employ widely accepted economic models to determine take rates that would be charged in a hypothetical but-for world without the Challenged Conduct. Before introducing the models, I briefly explain how multi-homing (by customers and developers) and steering (by developers) would put downward pressure on take rates in the absence of the Challenged Conduct.

A. Multi-Homing and Steering Would Put Downward Pressure on the Take Rate That Google Imposes on App Developers

281. Google's Challenged Conduct has enabled Google to charge developers supra-competitive take rates in the Android App Distribution Market and the In-App Aftermarket. With its dominance in the Android App Distribution Market and consequent market power in the In-App Aftermarket, Google is able to extract a supra-competitive take rate on all paid App downloads and purchases of In-App Content. This is true even after Google's reduction in its take rates announced in March 2021 (from 30 percent to 15 percent on the first $1 million of developer revenue)[659] and for subscription payments after the first year as of January 1, 2018 (reduced to 15

659. Sameer Samat (Google Vice President, Product Management), *Boosting Developer Success on Google Play*, ANDROID DEVELOPERS BLOG (Mar. 16, 2021), android-developers.googleblog.com/2021/03/boosting-dev-success html ("Starting on July 1, 2021 we are reducing the service fee Google Play receives when a developer sells digital goods or services to 15% for the first $1M (USD) of revenue every developer earns each year.") Although the new policy applied to all developers, the overall reduction in the take rate is less significant for larger developers, because it applied only to the first $1 million in revenue. For example, developer with $10 million in revenue would pay a 15 percent take rate on the first $1 million, and a 30 percent take rate on the remaining $9 million, which works out to an overall take rate of 28.5 percent.

percent).[660] The concepts of multi-homing and steering are critical to understanding how Google's contractual restraints with OEMs, developers, and mobile carriers work as an economic matter.

1. Multi-Homing

282. Multi-homing, as the name suggests, occurs whenever buyers or sellers on the opposite sides of a two-sided platform use more than one platform for the same or similar purpose. For example, many young Internet users have social media accounts on two or more social media platforms (e.g., Facebook and TikTok). Many ride-sharing drivers and riders have both Uber and Lyft on their phone, another form of multi-homing. Multi-homing is not exclusive to the digital world: People carry two or more credit cards in their wallets, and the stores they frequent accept more than one card, although anti-steering rules imposed by one of the most popular credit cards may inhibit card competition.[661]

283. In the context of this case, multi-homing exists to the extent consumers have App stores side-by-side on their mobile phone's home screens (if Google's conduct did not prevent consumers from having multiple App stores)—the adjacent placement is necessary so that multi-homing is equally convenient for consumers. When two platforms are sufficiently close substitutes in the eyes of buyers and sellers, multi-homing can lead to competitive outcomes that benefit both buyers and sellers.[662]

284. Multi-homing would occur absent the Challenged Conduct, as developers would be willing to distribute their applications through alternative App stores if they could achieve sufficient reach by doing so. And consumers would be willing to install the second App store on their home screens if (1) they could access their favorite Apps on a rival App store, and (2) if at least some of those Apps were available at a lower price on the second App store—a phenomenon that, in a competitive world absent Google's restrictions, would be made possible via steering.[663]

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660. Although Google decreased the take rate for subscription services from 30 percent to 15 percent in 2018, the decrease was only applicable after the first year. (It wasn't until January 1, 2022, that the take rate was reduced to 15 percent for all subscription services across the board). Google documents indicate that [redacted] of consumer spend on in-App purchases occurs within one year of the consumer's first purchase, which would have limited the effect of the 2018 policy. *See* GOOG-PLAY-007819776 at -909. Moreover, Google estimates in the lead-up to the announcement found only a $25 million revenue loss from the change, because only 23 percent of active subscriptions and 16 percent of revenue from subscriptions came after 12 months. *See* GOOG-PLAY-000446626.R at -629.R. Another Google analysis calculated the effective take rate resulting from the 2018 policy change at 28 percent. *See* GOOG-PLAY-001291233 at -251. In contrast, the competitive but-for world is one in which all developers would have enjoyed substantial and permanent reductions in the take rate and would be characterized by long-run equilibrium price adjustments to substantially lower developer costs flowing from substantially lower take rates. As a consequence, Google's reduction in the take rate for subscriptions is unlikely to provide an adequate natural experiment that could be used to accurately measure the extent to which consumers would have paid lower prices in the but-for world.

661. Even if there is multi-homing, restrictions can create less than a competitive outcome. *See, e.g.,* Kevin Caves & Hal Singer, *Competing Approaches to Antitrust: An Application in the Payment Card Industry*, 27(3) GEORGE MASON LAW REVIEW 823-861 (2020).

662. Susan Athey & Fiona Scott Morton, *Platform Annexation*, Stanford Inst. for Econ. Policy Research Working Paper 21-015 (March 2021).

663. Although my primary impact model focuses on price effects (over the take rate), it is possible that competition would occur on non-price quality dimensions as well. For example, a specialized App store could emerge that provided better discoverability features, forcing Google to compete on that dimension.

2. Steering

285. Steering can exist in any type of market, but in the context of the two-sided platform present in this case, steering would entail a developer charging differential prices to consumers based on which platform the consumer selects, from which to download an App. The developer's aim, if steering were allowed, would be to induce consumers to transact over a lower-cost platform.[664] Economists have shown that, in a platform setting, steering puts downward pressure on the prices charged by sellers (here, developers), and thus anti-steering restraints are almost certainly harmful to competition.[665] Indeed, Google was well aware of the power of steering to put downward pressure on take rates.[666] One Google document explains that developers attempting to provide consumers with alternative payment options [redacted]

286. Steering occurs regularly across platforms in other industries where there are no restrictions that prevent it. One example is the market for "daily deals"—or discounted prices on certain products or services on a specific day—offered by platform Apps like Groupon and Living Social. Empirical research has shown that in markets where there is platform competition, sellers on the sites offer more valuable promotions to buyers at lower prices relative to markets without platform competition.[668]

287. With multi-homing and steering—both conditions are necessary for competition to drive down prices to consumers—developers could, and would be incentivized to, charge a lower price for Apps to consumers who download Apps from a lower-cost App store platform. Consider a scenario in which a developer faced two take rates: Google's 30 percent rate and a rival App store's 15 percent rate. For simplicity, assume the developer charges $1 for downloading the App. In a world with multi-homing, the developer would have strong incentives to steer its customers to the lower-cost platform, as doing so would save it $0.15 per download (equal to the product of

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664. *See, e.g.,* Rochet & Tirole at n. 3 ("The occurrence of steering is easiest to visualize in those illustrations in which platforms charge per-end-user-transaction fees: The seller of a house or a B2B supplier may only list the house or the wares on the cheapest platform.").

665. *See, e.g.,* Benjamin Edelman & Julian Wright, *Price Coherence and Excessive Intermediation,* 130 Q. J. ECON. 1283 (2015); Rong Ding, *Merchant Internalization Revisited,* 125 ECON. LETTERS 347 (2014); Rong Ding & Julian Wright, *Payment Card Interchange Fees and Price Discrimination*, 65 J. IND. ORG. 39 (2017). For an overview of the intersection of multi-homing and steering, see Erik Hovenkamp, *Platform Antitrust*, 44 JOURNAL OF CORP. LAW 713 at 18-19 (2019) ("A second type of steering is undertaken by sellers on one side of a transaction platform. In most situations where buyers and sellers both multi-home, the buyer ultimately chooses the platform used to mediate his transactions. … Alternatively, the seller may vary the prices it charges in transactions over different platforms, applying a surcharge to those it disfavors (or, equivalently, a discount for transactions on its preferred platform). Such steering efforts were forestalled by the restraint at issue in *AmEx*, which is discussed further below.").

666. GOOG-PLAY-006829073.R at GOOG-PLAY-006829085.R.

667. GOOG-PLAY-007755618 at 5619 [redacted] Most of these developers already use web top-up or have their own gift card but so far have not been able to communicate about these alternative payments in-App since we have enforced these in-App communications."). *See also* GOOG-PLAY-011269238 at -287 (a Google slide that reads "App Stores need not be winner-take-all" at point 3, suggesting worry over multi-homing if other App stores gained a foothold).

668. Kim et al., *Two-sided platform competition with multihoming agents: An empirical study on the daily deals market*, 41 INFORMATION ECON. AND POLICY 36-53 (2017).

the 15 percent differential in take rates and $1). Indeed, the developer would be willing to offer up to a $0.15 reduction in the price of the App to steer its customers to the lower-cost platform. As more customers shift their downloads to the rival platform, Google would be forced to revisit its take rate; a lower Google take rate would in turn induce developers to lower their prices on the Play Store. I model this competitive dynamic formally in the following sections.

B. A Two-Sided Platform Model with Multi-Homing Shows That Google Would Be Compelled to Lower Its Take Rate from Developers in the Absence of Google's Android App Distribution Market Restraints

288. I start by analyzing the impact of the Challenged Conduct in the Android App Distribution Market. For this purpose, I use a model based on the one developed by economists Jean-Charles Rochet and Jean Tirole (winner of the Nobel prize in economics for, among other things, his pioneering work on monopolized industries) who formalized the economic framework for two-sided markets.[669] This framework has been widely cited by other economists.[670]

289. The model shows by how much Google's take rate on paid initial App downloads in the Android App Distribution Market would fall if the locus of competition occurs on the developer side of the platform once Google's multiple restraints and technical barriers are removed. The model shows what Google would charge developers in the presence of multi-homing and steering, which would occur in the absence of Google's exclusionary restraints. Although Google's exclusionary conduct was aimed at myriad potential entrants—including mobile carriers, OEMs, and developers—my analysis of a potential but-for world requires entry by only one viable rival App store platform. Although Google has consistently charged a take rate at (or very close to) 30 percent for the vast majority of consumer expenditures,[671] my analysis also takes account of Google's current take rates. For example, the take rate has been lowered from 30 to 15 percent for (1) subscription App renewals beginning January 1, 2018, and (2) transactions made for Apps and In-App purchases for a developer's first $1 million in annual sales beginning July 1, 2021.[672] I discuss the basic intuition behind this model and show how it can be readily adapted to the current setting.

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669. Rochet & Tirole, *supra*.

670. *See, e.g.*, Avi Goldfarb and Catherine Tucker, *Digital Economics*, 57 JOURNAL OF ECONOMIC LITERATURE 3-43 (2019); Joseph Farrell & Paul Klemperer, *Coordination and lock-in: Competition with switching costs and network effects,* in MARK ARMSTRONG AND ROBERT PORTER EDS., 3 HANDBOOK OF INDUSTRIAL ORGANIZATION (Elsevier 2007).

671. *See, e.g.*, Table 8, *infra*, Row 3 (showing that Google collected service fees in excess of [redacted] of consumer expenditures from 8/16/2016 – 5/31/2022).

672. The relatively few developers who paid reduced take rates in the actual world would also have paid take rates below the but-for level. Google's anticompetitive conduct resulted in a substantially inflated headline take rate of 30 percent, which is economically equivalent to inflating the list price of a product in an antitrust context. Customers that receive discounts from an inflated list price still incur antitrust injury because the discounts they receive are tied to the list price. *See, e.g.,* Hal Singer and Robert Kulick, *Class Certification In Antitrust Cases: An Economic Framework,* GEORGE MASON LAW REVIEW 1046, 1049 (2010) (explaining that U.S. Consumers are impacted even when they receive discounts relative to an inflated list price; here the list price is Google's headline take rate of 30 percent). Thus, even developers who paid reduced take rates in the actual world would have also paid lower take rates in the but-for world, and would have passed on some of the resulting savings to consumers. In Part VIII, I demonstrate how damages can be calculated for individual U.S. Consumers using common methods, taking into account the fact that a limited number of developers received discounts relative to Google's standard 30 percent take rate.

290. In the event that the factfinder concludes that the Android App Distribution Market and In-App Aftermarket are not two separate markets, I have performed alternative analyses which apply the two-sided market framework to a single, combined market. These analyses (presented Part VI.H and Appendix 4) contemplate competitive scenarios in which platforms compete for all transactions (both initial downloads and in-App purchases) in the aggregate. In Part VI.E, I present a model in which the locus of competition occurs on the consumer side.[673] In Appendix 4, I present a model in which the locus of competition occurs on the developer side of the platform, and a model in which competition occurs on both the developer and consumer sides of the platform.

1. The Platform Model in a Monopolized Setting

291. The two sides of the Android App Distribution Market are consumers of initial paid App downloads (buyers) and App developers (sellers). Google sets the commission it has charged developers for using the Play Store. Google does not charge consumers for accessing the Play Store and instead offers a small subsidy in the form of its loyalty points program, Google Play Points, effectively implying a small *negative* price (or subsidy) for consumers using the Play Store.[674] Importantly, while Google sets the commission charged to developers, developers set their own prices on App downloads.[675] As my extension of the Rochet-Tirole model illustrates, developers that can offer their Apps on an App store that charges a lower commission than Google will be incentivized to "steer" consumers to the alternative App store by charging lower prices on downloads in that alternative App store than they charge in the Play Store. In this way, consumers would also benefit from competition between App stores.

292. I first outline the classic two-sided market model in which a platform operator sets per-transaction platform prices on both sides of the market where the platform operator has a monopoly (the "foundational monopoly model"). I then demonstrate how this model is easily extended to the instant case, where Google sets a take rate or commission imposed directly on developers instead of a per-transaction price and provides a subsidy to consumers in the form of loyalty points (the "applied monopoly model"). A portion of the supracompetitive cost imposed on developers through the take rate is passed through to consumers (which I show in Section VI.D below). I then describe the foundational and applied models in a setting where there is platform competition.

a. The Foundational Monopoly Platform Model

293. The Rochet-Tirole model was developed in a situation in which the operator of the two-sided platform has a monopoly and sets per-unit prices on both sides of the market to sellers and buyers.

294. In the instant case, Google controls the substantial majority of all App downloads on Android-compatible mobile devices and can thus appropriately be thought of as a platform

673. The model presented in Part VI.E can also be applied if there are two relevant markets.

674. The subsidy referenced here is paid by Google to the consumer. The consumer still pays a positive price to the developer—albeit a lower one due to the subsidy.

675. Google limits prices to between $0.05 and $400.00 on the Google Play Store. Google - Play Console Help, *Supported locations for distributions to Google Play users*, support.google.com/googleplay/android-developer/answer/10532353?visit_id=637777015722462270-3131223409&rd=1.

monopolist. As a platform operator, Google has the ability to charge both buyers and sellers for using the Play Store.

295. Google's charge to consumers (buyers) can be thought of as Google's ability to charge for transactions, which I denote as P_B. As is typical for many two-sided markets, Google sets the consumer access price (in this case, a subsidy) near zero.[676] As for developers (sellers), Google charges a take rate, or percentage of sales, of up to 30 percent. The foundational model uses a per-unit transaction price on the seller side, which I denote as P_S, instead of a percentage take rate. In the foundational model, P_B and P_S should be understood as prices charged to consumers (buyers) and developers (sellers), respectively, for a transaction made on the platform. These prices are distinct from the price of the actual product being purchased (App downloads). Maximizing profit (by taking the derivative of the profit equation with respect to both prices) leads to an optimal pricing rule under a two-sided monopoly platform:

(V.1)
$$\frac{P_B + P_s - C}{P_B + P_s} = \frac{1}{\varepsilon_B + \varepsilon_S}$$

where $\varepsilon_B, \varepsilon_S$ are the price elasticities of demand for the buyer and seller, respectively.[677] The left-hand side of this expression represents the platform operator's per-unit margin. In maximizing its profit, the monopolist will choose to set platform prices to buyers and sellers according to their price elasticities of demand, and C represents the platform operator's incremental cost of executing a transaction. As observed in Rochet and Tirole 2003, when expressing the total price charged by the platform ($P = P_B + P_S$) and the combined elasticity with respect to both sides of the market faced by the platform ($\varepsilon = \varepsilon_B + \varepsilon_S$), Equation (V.1) simplifies to what is known as the Lerner index, the standard inverse elasticity formula:

(V.2)
$$\frac{P - C}{P} = \frac{1}{\varepsilon}$$

This expression is widely recognized in economic theory and suggests that firms with pricing power increase prices until the markup of price over marginal cost is equal to the inverse of the firm's own-price elasticity.[678]

b. Application of the Two-Sided Monopoly Platform Model to the Play Store

296. I now adapt the Rochet-Tirole model set out above to fit the current circumstances. I accommodate three key features that distinguish the adapted model from the foundational monopoly model described above. *First*, Google charges a take rate to developers on the Play Store as a percentage of developers' revenues rather than a per-unit price. *Second*, as I demonstrate later in Part VI.D using standard economic principles, the take rate imposed on developers is passed

676. *See, e.g.,* John M. Newman, *Antitrust in Zero-Priced Markets: Foundations*, 164 PENN LAW REVIEW 149-206 (2015). The consumer also pays for access by sharing her data with the platform operator.

677. Rochet & Tirole at 996-997. In mathematical terms, the elasticity of demand is defined as the percentage increase in demand divided by the percentage decrease in prices.

678. *See, e.g.,* Landes & Posner at 937 (1981).

through at least in part to consumers. This pass-through results in product prices that will be affected by the take rate. *Third*, through its Play Points loyalty program and other promotions, Google offers a subsidy (a negative platform price) on the consumer side.

297. I define the take rate t as the commission charged by Google to developers for using the platform (typically 30 percent with the exceptions discussed above). The per-unit amount paid to Google by the developer is equal to the take rate multiplied by the product price, which I will denote as S. For example, if an App is priced at $S = \$10$ and the take rate is 30 percent, Google retains 0.3*$10 = $3. Indeed, this arrangement is analogous to setting platform prices $P_S = tS$. It is important to note that the *product* price S is also affected by the take rate, because the take rate represents a cost to developers, a significant portion of which is typically passed on to consumers in the form of higher product prices. I estimate the rate of pass-through in Section VI.D and denote it here with the symbol γ. The pass-through rate is equal to the portion of an increase in costs incurred by developers (including those from increased commissions), which is passed through to consumers in the form of higher product prices. For example, if costs to a developer increase by one dollar, a pass-through rate of 0.90 means that product prices for consumers increase by $0.90. Allowing for this relationship, Equation (V.1) becomes:

(V.3)
$$\frac{P_B + tS - C}{tS + t^2S'} = \frac{1}{\varepsilon_{B,t} + \varepsilon_{S,t}}$$

where $\varepsilon_{B,t}$ and $\varepsilon_{S,t}$ are price elasticities of demand for transactions from buyers (consumers) and sellers (developers), respectively, now taken with respect to the take rate t, which takes the place of the platform price, and t^2S' is an additional term which accounts for the effects of the take rate on the product price.[679] Appendix 3 contains a derivation of Equation (V.3).

2. The Platform Model in a Competitive Setting

a. The Foundational Competitive Model

298. When competition to the platform monopolist is introduced, both buyers and sellers can connect to more than one platform, which, as discussed above, is known as multi-homing.[680] With multi-homing, the monopolist loses some pricing power, resulting in a lower equilibrium take rate. The competitive pressure on the take rate occurs through two channels: (1) the platform's

679. S' represents the amount by which the product price S changes when there is a change in the take rate. Appendix 3 contains further details regarding this term.

680. Rochet & Tirole at 991-992 ("In a number of markets, a fraction of end users on one or the two sides connect to several platforms. Using the Internet terminology, we will say that they 'multihome.' For example, many merchants accept both American Express and Visa; furthermore, some consumers have both Amex and Visa cards in their pockets. Many consumers have the Internet Explorer and the Netscape browsers installed on their PC, and a number of Web sites are configured optimally for both browsers.").

incentive to attract sellers, and (2) sellers' ability to steer buyers by way of lower product (in this case App) prices.[681]

299. All else equal, sellers will prefer to use the platform that charges a lower seller-side platform price (P_S), assuming that the alternative platform is roughly comparable and therefore attracts a significant base of consumers. A competing platform under this assumption can therefore attract sellers away from a rival by offering a lower platform price. This first effect on platform prices, namely downward pressure in the face of competition, is analogous to the familiar forms of price competition that occur in countless industries.

300. A second effect stems from sellers' incentive to avoid a higher take rate, all things equal, while having access to the most buyers possible. Because sellers here set their own product prices, they can "steer" buyers to a platform by offering lower product prices on that platform. Steering is facilitated when a rival platform charges a lower platform price, because a seller using the platform with a lower platform price has a price differential available to lower prices and steer customers.

301. In a competitive platform setting, the platform's optimal pricing rule from Equation (V.1) becomes:[682]

(V.4)
$$\frac{P_B + P_S - C}{P_B + P_S} = \frac{1}{\varepsilon_{OB} + \varepsilon_{OS}}$$

This formula now reflects the buyers' "own-brand" elasticity, ε_{OB}, and the sellers' "own-brand" elasticity, ε_{OS}. Own-brand elasticity is the change in demand for a given platform due to an increase in the price of transacting on that particular platform. This elasticity varies from the elasticity in the monopoly setting due to the presence of competition from rival platforms. In a monopoly setting, a consumer may choose not to transact in the face of a price increase but will not have the option of transacting on an alternative platform. In a competitive setting, a consumer may choose not to transact at all or may choose to transact on a competing platform. The presence of a competitive option suggests a greater elasticity of demand relative to that of the monopoly setting.

302. The own-brand elasticities cause the denominator on the right-hand side of Equation (V.4) to increase relative to the denominator in Equation (V.1). This higher denominator leads to a lower margin on the left-hand side, which implies lower equilibrium platform prices ($P_B + P_S$) in the presence of competition.

681. *Id.* at 1001 ("This increases demand for Platform 1 in two ways: The platform attracts new merchants…and 'steers' former multihoming merchants.").

682. *Id.* at 1004. I derive this expression by replacing market demand faced by the platform operator (in the monopoly setting) with residual demand, where residual demand is defined as market demand minus demand that is met by the platform's rivals. Rochet and Tirole model competition in the form of a duopoly and express the seller side own-brand elasticity as $\varepsilon_{OS} = \varepsilon_S/\sigma$, where σ is a single-homing index. I use the more general notation to show that in my extension of the model, I am agnostic to the number of competing platforms faced by Google, as long as there is at least one rival. Appendix 3 provides details regarding this derivation.

b. Application Of The Two-Sided Competitive Platform Model to The Instant Case

303. Applying the competitive model to this case results in an expression analogous to Equation (V.4):

(V.5)
$$\frac{P_B + tS - C}{tS + t^2S'} = \frac{1}{\varepsilon_{OB,t} + \varepsilon_{OS,t}}$$

As in Equation (V.3), the platform prices P_s on the left side of the expression has been replaced with its take rate analogue (tS), and there is an additional term in the denominator which accounts for the effect of a new take rate on product prices. The platform price elasticities on the right-hand side have also been replaced with their take rate analogues, now reflecting the introduction of competition ($\varepsilon_{OB,t}$ is own-brand elasticity of demand taken with respect to the take rate on the buyer side, and $\varepsilon_{OS,t}$ is own-brand elasticity of demand taken with respect to the take rate on the seller side). As in the foundational model, the competitive elasticity terms imply a lower take rate in this equation. Table 5 summarizes these equations, comparing the foundational framework with the extension that allows for a percentage take rate. Details of how these expressions are derived are in Appendix 3.

TABLE 5: EQUILIBRIUM EXPRESSIONS OF THE ROCHET-TIROLE MODEL APPLIED TO THE INSTANT CASE

Scenario	Foundational Model	Applied Model
Monopoly	$\frac{P_B + P_s - C}{P_B + P_s} = \frac{1}{\varepsilon_B + \varepsilon_S}$ (Eqn. (V.1))	$\frac{P_B + tS - C}{tS + t^2S'} = \frac{1}{\varepsilon_{B,t} + \varepsilon_{S,t}}$ (Eqn. (V.3))
Competitive	$\frac{P_B + P_S - C}{P_B + P_S} = \frac{1}{\varepsilon_{OB} + \varepsilon_{OS}}$ (Eqn. (V.4))	$\frac{P_B + tS - C}{tS + t^2S'} = \frac{1}{\varepsilon_{OB,t} + \varepsilon_{OS,t}}$ (Eqn. (V.5))

3. Calibrating the Model and Required Inputs

304. Once the model is "calibrated" in the sense that it relates the observed variables in the monopoly setting in Table 5 and solves for the unobserved variables, the model can be used to project Google's take rate in a competitive setting. I demonstrate impact by proceeding in two steps. *First*, I calibrate the Applied Model in the monopoly scenario by estimating inputs in the observed setting in which Google wields monopoly power in the Android App Distribution Market, thus satisfying Equation (V.3). The model's inputs are informed entirely by paid Apps in the Android App Distribution Market, as those are the only Apps that are priced and thus exhibit an observable own-price elasticity of demand. *Second*, I use the competitive inputs—namely, the take rate elasticities of demand—to determine a competitive take rate in a competitive (but-for)

world, thus satisfying Equation (V.5). Data obtained from Google and other sources can be used in the applied monopoly and competitive models. In the descriptions below, I use the superscript ^{M} to denote inputs to the monopoly model (Equation (V.3)) and the superscript ^{C} to denote inputs to the competitive model (Equation (V.5)). My sources and methods for obtaining the monopoly scenario inputs shown in Equation (V.3) are:

- P_B^M is equal to the price "charged" by Google to consumers for transactions made on its platform in the monopoly scenario. Through its Play Points loyalty program and other promotions, Google effectively charges a small negative price to consumers. As it does in the actual world, Google maximizes its profits with respect to all Apps collectively, not App-by-App. Therefore, I use Google's average subsidy across all Apps, not individual subsidy amounts, to calculate P_B^M. I compute the value of this subsidy as the sum of all promotions paid by Google for paid Apps downloaded in the Android App Distribution Market divided by the total quantity of paid Apps downloaded in the Android App Distribution Market, per Google's transaction records.

- t^M is equal to the observed take rate, computed as the sum of all revenue retained by Google in the Android App Distribution Market divided by the sum of total revenue spent by consumers in the Android App Distribution Market. t^M therefore represents the portion of consumer spending that Google "takes" from the developer. I calculate t^M prior to extracting Google's promotional payments to consumers (promotional payments are captured by P_B^M).

- S^M is equal to the average price charged for Apps in the Android App Distribution Market (for paid App downloads only) in the monopoly setting. In the monopoly model, S^M is total consumer expenditure (prior to receiving promotions from Google) in the Android App Distribution Market divided by the total quantity of paid Apps downloaded, as observed in Google's transaction records. As it does in the actual world, Google would maximize its profits with respect to all Apps collectively, not App-by-App. Therefore, I use Google's average App price across all Apps, not individual App prices, to calculate S^M.

- Marginal cost C represents the incremental cost incurred by Google in executing a transaction. I refer to Google's financial data to infer this value, which suggests that transaction fees and direct costs that Google records for the Play Store (excluding content costs) are approximately [redacted] percent of consumer expenditures.[683]

- γ is equal to the change in the App price S charged to consumers with respect to a change in developers' costs (including the cost imposed on developers through Google's take rate), also known as the pass-through rate. This parameter is discussed in detail in Part VI.D,

683. I estimate that Google's direct costs of sales and direct operating expenses for the Play Store (excluding irrelevant content costs for movies, television, and books) to be [redacted] percent of consumer expenditures on the Play Store for the period 2016 – 2021. In addition to transaction fees, the Play Store's direct costs of sales includes content costs, customer support, and other costs. I include all of these except content costs; these are costs Google incurs for sales of books, movies, and television, and are not part of the relevant markets here. I also include all direct operating expenses, which include payroll & stock-based compensation, as well as the following non-payroll costs: professional services, advertising and promotional expenses, equipment, and other expenses (travel and entertainment, office and related expenses). *See* work papers for this report.

where I estimate its value at approximately 91 percent (91.1 percent). This value implies that an increase in the take rate that adds \$1.00 in extra cost to a developer will cause an increase in the price of the App product of \$0.91. Mathematically, the pass-through rate is:

$$\gamma = \frac{\text{change in revenue}}{\text{change in costs}} \tag{V.6}$$

- S'^M represents the change in the product price resulting from a small change in the take rate. I solve for S'^M in terms of the take rate and pass-through rate: $S'^M = \frac{\gamma}{(1-t^M\gamma)} S^M$. Appendix 3 contains a derivation of this expression.

- $\varepsilon_{B,t}^M$ and $\varepsilon_{S,t}^M$ are the take-rate elasticities of demand for transactions in the Android App Distribution Market from consumers and developers, respectively, in the presence of Google's monopoly. $\varepsilon_{B,t}^M$ reflects the change in the quantity demanded by consumers for Android App Distribution Market transactions associated with a change in the take rate in a monopoly setting. A change in the take rate affects the price at which App products (paid App downloads and purchases of In-App Content) are set via pass-through, which in turn affects consumer demand. $\varepsilon_{S,t}^M$ reflects the change in the number of paid Apps sold by developers in response to a change in the take rate in a monopoly setting. Given the other inputs to the monopoly model, the value of $\varepsilon_{B,t}^M + \varepsilon_{S,t}^M$ is implied by Equation (V.3). Further description of these inputs is included in Appendix 3.

I hold inputs C and γ fixed between the monopoly and competitive scenarios. My sources and methods for obtaining the remaining inputs to the competitive scenario expression shown in Equation (V.5) are:

- P_B^C is equal to the price "charged" by Google to consumers for transactions made on its platform in the competitive scenario. Holding the buyer-side platform price fixed in proportion to the product price yields: $P_B^C = \left(\frac{P_B^M}{S^M}\right) * S^C$.[684]

- t^C is equal to the but-for (competitive) take rate. I calculate the but-for take rate by finding the value that satisfies Equation (V.5) given the remaining inputs.[685]

- S^C is the price of paid App downloads that developers would charge in a competitive scenario. S^C can be inferred if the pass-through rate is known by using Equation (V.6). In particular, plugging in the change in revenue and change in costs associated with the monopoly versus a competitive scenario:

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684. In Section VI.E, I model a scenario in which the locus of competition occurs on the buyer-side platform price P_B, resulting in a but-for buyer-side platform price that differs from the observed, monopolistic price.

685. If all the inputs to Equation (V.5) are known except for the take rate, I can solve for the take rate that satisfies the equation.

(V.7)
$$\gamma = \frac{\text{change in revenue}}{\text{change in costs}} = \frac{(S^M - S^C) * \text{quantity}}{(t^M S^M - t^C S^C) * \text{quantity}}$$

This expression can be further simplified and re-arranged to express the competitive price S^C in terms of other inputs:

(V.8)
$$S^C = S^M \frac{1 - \gamma t^M}{1 - \gamma t^C}$$

- S'^C represents the change in the product price resulting from a small change in the take rate in the competitive setting. I solve for S'^C in terms of the take rate and pass-through rate: $S'^C = \frac{\gamma}{(1-t^C\gamma)} S^C$. Appendix 3 contains a derivation of this expression.

- $\varepsilon^C_{OB,t}$ and $\varepsilon^C_{OS,t}$ are the "own-brand" take-rate elasticities of demand for transactions in the Android App Distribution Market for consumers and developers, respectively, in the presence of competition. $\varepsilon^C_{OB,t}$ reflects the change in the quantity demanded by consumers for Android App Distribution Market transactions—from Google in particular, hence, "own-brand"—associated with a change in Google's take rate. Relative to its monopoly analogue, this parameter reflects a scenario where Google faces competition from rival platforms; as such, the parameter will be greater in magnitude than the monopoly elasticity, because the presence of a competitor allows easier defection by consumers in the presence of a price increase from Google, and thus more sensitivity. $\varepsilon^C_{OS,t}$ reflects the change in the quantity of transactions demanded by developers—on the Play Store in particular, hence "own-brand"—in response to a change in the take rate, again in the presence of platform (App store) competition. To inform the but-for competitive elasticities as shown in the denominator of Equation (V.5), $\varepsilon_{OB,t} + \varepsilon_{OS,t}$, I draw from the economics literature, empirical evidence of industries that have shifted from monopoly to competition. I conservatively estimate that Google's take rate elasticities shift from a value of 2.14 (in the monopoly setting, as calculated using Equation (V.3)) to 2.58 in the competitive setting. I arrive at 2.58 using the relationship between own-brand elasticity and market demand elasticity, and under the conservative assumption that Google maintains a 60 percent market share with an inelastic supply response from Google's rivals.[686] These inputs are defined mathematically in Appendix 3.

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686. Similar to Part VI.C, *infra*, I use the relation $E_g = \frac{E_M}{S_g} + \frac{E_S(1-S_g)}{S_g}$ where E_g is Google's own-brand elasticity, E_M is market elasticity, S_g is Google's market share, and E_S is the elasticity of supply of Google's rivals (conservatively set to zero). *See* Landes & Posner at 939-940. I conservatively assume Google maintains a 60 percent market share in a competitive market and that $E_S = 0$. AT&T saw its market share decline to approximately 60 percent by the early 1990s after losing its monopoly. *See, e.g.,* Simran Kahai, David Kaserman & John Mayo, *Is the "Dominant Firm" Dominant? An Empirical Analysis of AT&T's Market Power*, 39 JOURNAL OF LAW & ECONOMICS 499-517 (1996). This implies that the buyer price elasticity of demand changes from 5.383 in the monopoly setting (estimated using Equation V.11) to 8.97 = 5.383/0.6 in the competitive setting, which translates to a competitive take rate elasticity of 2.284, and that the seller price elasticity of demand changes from 0.140 (calculated using Equations

4. Competitive Take Rate Results

305. Table 6 summarizes the results of calculating inputs as described above. As seen below, Table 6 uses both the Google Transaction Data and the App Revenue Metrics data. I estimate that in the but-for world, platform competition results in a competitive take rate of [redacted] percent, down from its observed value of [redacted] percent in the actual world. This result is calculated from Equation (V.5), by finding the value for t that satisfies the equation, given all other inputs. As Table 6 shows, at a pass-through rate of $\gamma = 91.1$ percent, the resulting but-for average price of paid App downloads in the Android App Distribution Market is [redacted] down from the observed price of [redacted] (net of Google's promotional expenditures to consumers). This difference results in an average overcharge to consumers of [redacted] per paid App download (equal to [redacted] which demonstrates impact, and results in aggregate damages of [redacted] (equal to [redacted] paid App download transactions) as a result of Google's restrictions in the Android App Distribution Market, across the Class Period (August 16, 2016, through May 31, 2022) for the U.S. As explained below, there are additional damages and impact in the In-App Aftermarket.[687]

V.3 and A.22) to 0.233 = 0.140/0.6, which translates to a competitive seller take rate elasticity of 0.292 (see Appendix 3 for details on the relation between the price elasticities of demand and take rate elasticities of demand). The sum total of both competitive elasticities is then equal to 2.284 + 0.292 = 2.58.

687. In the event that proof of pass-through is not necessary under the law, I have been asked to calculate damages based on the full reduction in the take rate in the but-for world. I do so in Part VII.A below.

TABLE 6: ANDROID APP DISTRIBUTION MARKET IMPACT AND DAMAGES
(U.S., 8/16/2016 – 5/31/2022)

Actual World (Monopoly, Eqn. (3))

#	Input	Description	Value	Source/Notes
[1]		Consumer Expenditure (US; Before Discounts)	[redacted]	GOOG-PLAY 005535886; Google Transaction Data (US Consumers)
[2]		Google Revenue (US; Before Discounts)		*Id.*
[3]		Google Promotional Expenditures (US)		*Id.*
[4]		Android App Distribution Market (Paid) Transactions (US)		*Id.*
[5]=[1]/[4]	S^M	App Product Price Before Discounts		Calculated
[6]=[2]/[1]	t^M	Take Rate		Calculated
[7]=-[3]/[4]	P_B	Buyer-side Platform Price		Calculated
[8]=[5]+[7]	$S^M + P_B$	App Product Price Net of Discounts		Calculated
[9]	C	Marginal Cost		GOOG-PLAY-000416245; GOOG-PLAY-010801682
[10]	γ	Pass-through Rate		Estimated (See Table 13)
[11]	$\varepsilon^M_{B,t} + \varepsilon^M_{S,t}$	Take Rate Elasticities of Demand		Calculated (Eqn. (V.3))

But-For World (Competitive, Eqn. (5))

#	Input	Description	Value	Source/Notes
[12]	S^C	App Product Price		Calculated (Eqn. (V.8))
[13]	t^C	Take Rate		Calculated (Eqn. (V.5))
[14]=([7]/[5])*[12]	P_B	Buyer-side Platform Price		Calculated
[15]=[12]+[14]	$S^C + P_B$	App Product Price Net of Discounts		Calculated
[16]=[9]	C	Marginal Cost		GOOG-PLAY-000416245; GOOG-PLAY-010801682
[17]=[10]	γ	Pass-through Rate		Estimated (See Table 13)
[18]	$\varepsilon^C_{OB,t} + \varepsilon^C_{OS,t}$	Take Rate Elasticities of Demand		Economic theory/empirical studies
[19]=[8]-[15]		Consumer Savings Per Transaction		Calculated
[20]=[19]*[4]		**Aggregate Damages**		Calculated

Notes: Expenditures, revenues, and unit totals are limited to transactions on smartphones and tablets. I calculated these using GOOG-PLAY 005535886 (Google App Revenue Metrics Data) over the period 8/16/2016-1/31/2017, [redacted] I calculated Google promotional expenditures as follows: For the period 8/2016 – 1/2017, I summed the [redacted] fields from the App Revenue Metrics data. For the period 2/2017 – 5/2022, I relied on the Google Transaction Data, which provides a

breakdown of each revenue distribution from one party to another once a transaction occurs. I calculated the difference between the initial purchase buyer-to-developer revenue distribution, which is approximately equal to the "price_per_unit" before discounts are applied, and the pre-tax consumer spend net of discounts. Correspondence from Google suggests that this calculation takes promotional dollars earned through Play Points into account. *See* Letter from Brian C. Rocca, Morgan Lewis, to Gregory Arenson, Kaplan Fox & Kilsheimer LLP, in re Google's Transactional data (January 14, 2022) ("These discounts [the difference between the "price_per_unit" and the "sale_revenue_pricing.pre_tax_amount micros" fields] may reflect promotions from Google, promotions from developers (that are co-funded by developers and Google), and Google Play loyalty point redemptions."). To be conservative, I also aggregated Play Points earned across all transactions, assigned each point a dollar value of $0.01, and added this to the promotional expenditures total. *See* Shelby Brown, *Google Play Points Could Help You Save Money. Here's How*, CNET (Feb. 21, 2022), *available at* https://www.cnet.com/tech/services-and-software/google-play-points-could-help-you-save-money-heres-how/ ("A $1 Google Play credit costs 100 Play Points"). *See also* Letter from Brian C. Rocca, Morgan Lewis, to Gregory Arenson, Kaplan Fox & Kilsheimer LLP, in re Google's Transactional data (October 11, 2021) at 61-62 (explaining that the "transactional_points" field "contains non-negative integers that indicate points earned due to the transaction" and is only populated from 2017 onward "consistent with when Play Points launched.").

306. Developer-specific take rates can be computed by applying the proportion of discounts granted in the actual world to the competitive but-for take rate. For example, suppose that the overall take rate is 30 percent in the actual world. Suppose a developer has an actual take rate of 29 percent (one percentage point below the overall rate). Suppose that the overall but-for take rate is 23 percent. In this example, the developer's but-for take rate would be calculated as [23 percent] x [29 percent]/[30 percent] = 22.2 percent. The pass-through rate γ (which I set equal to 91.1 percent for this analysis) may also vary across categories of Apps. Differential pass-through rates can be readily estimated (see Part VI.D.3) and inserted into the model to determine competitive but-for take rates that vary across App category, as illustrated in Part VII below. U.S. Consumers who made purchases in those App categories were accordingly subject to overcharges; lower take rates associated with consumer purchases in the but-for world would be passed through in the form of lower App prices relative to the actual world.

5. Analysis Of Similar Platforms Corroborates My Competitive Take Rates For Initial App Downloads

307. The framework described above demonstrates the economics of two-sided platforms and allows estimation of a take rate for the Android App Distribution Market in a competitive but-for world. This model is particularly useful in the present context where the Challenged Conduct has been inherent to Google's business practices since approximately the inception of the Play Store, preventing a "before, during, and after" comparison. A comparative analysis, presented here, can be used to corroborate the results from the two-sided market model. In this section, I review take rates found in similarly situated, two-sided digital platforms. I focus on take rates from platforms where there are no (or fewer) anticompetitive restraints similar to those imposed by Google in the instant case, and the fundamentals of platform economics (connecting two sides of a market) are present. From these examples, several conclusions emerge:

- Platforms facing more competitive conditions compete by lowering their take rates;
- Customer mobility, which hinges on the presence of substitutes and the absence of switching costs, puts downward pressure on the take rate via steering; and
- Take rates in competitive environments reflect the diminishing value offered by the platform over time following the initial matching of buyer and seller.

a. The ONE Store

308. South Korean wireless carrier SK Telecom Co. spearheaded the launch of the ONE Store, a competing mobile App store in 2016.[688] The scale of this effort to compete with Google is a testament to the barriers to entry: it involved cooperation among the three largest Korean wireless carriers (SK Telecom, KT, and LG Uplus), as well as Naver, Korea's largest search engine.[689] These parties were able to achieve near-universal availability in South Korea of the rival App store by having it pre-installed on every Android handset provided by these three companies.[690] The ONE Store achieved a 14.9 percent share of payment volume among App stores in South Korea.[691] The ONE Store has managed to gain share of payment volume in large part thanks to its significantly lower take rates, as well as an aggressive points system for consumers. The ONE Store has a headline 20 percent take rate for developers, which is lowered to five percent if the developer uses its own payment platform.[692] ONE Store's CEO credits its lower take rates compared to Google's 30 percent rate with increasing ONE Store's presence in its domestic market and increasing the number of users purchasing App products (both paid App downloads and purchases of In-App Content).[693] In October 2020, ONE Store announced a 50 percent discount on commissions for small developers (those with revenue less than 5 million won per month).[694]

309. The ONE Store has been identified by Google as a competitive risk due to its lower take rate.[695] The ONE store originally charged a 30 percent commission from its launch in March 2016, and cut its take rate to the 20 percent level (five percent if developers provide their own payment platform) in July 2018 to compete against Google.[696] Developers can now (setting aside any restrictions by Google) steer their customers to the lower-cost platform via discounting prices to consumers for Apps. This episode demonstrates that multi-homing competition among App store platforms engenders competition along the take-rate dimension.

310. The scale of the alliance of the three largest wireless carriers in South Korea enabled the ONE Store to overcome the prohibitive restrictions to competition imposed by Google. Google's revenue-sharing agreements with carriers were designed to prevent such a launch of a

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688. Lim Young-sin & Choi Mira, *Korea's home-grown integrated App market One Store on global outreach,* PULSE (Nov. 13, 2019), pulsenews.co.kr/view.php?year=2019&no=938924.

689. *Id.*

690. GOOG-PLAY-000005203.R at -264.R ("Pre-installed on (virtually) every phone sold in SK[.]").

691. Kim Eun-jung, *Korean App market ONE store eyes global alliance to compete with Google*, YONHAP NEWS AGENCY (Dec. 1, 2019), en.yna.co kr/view/AEN20191128004700320.

692. *Id.* ("ONE store cut the rate to 20 percent in July 2018. For App providers with their own payment platform, the firm only charged 5 percent for its service.").

693. *Id.* ("The rate cut not only helped the firm [the ONE Store] to expand its presence in the domestic market but also improved profitability with an increased number of paid users, he said. . . With the additional firepower, Lee said ONE store will bolster efforts to create an alternative global App store capable of competing with Google and enhance the App industry ecosystem. 'A monopolistic market is not healthy for both industry players and consumers,' Lee said. 'We need more competition, not only in the domestic market but also on the global scale.'").

694. ET Telecom.com, *South Korea's App market ONE store grows amid Google's Play store policy row* (Feb. 21, 2021), telecom.economictimes.indiatimes.com/news/south-koreas-app-market-one-store-grows-amid-googles-play-store-policy-row/81135498.

695. *See, e.g.,* GOOG-PLAY-000005203.R at -215.R. *See also* GOOG-PLAY-000445443.R at -451.R.

696. Kim Eun-jung, *Korean App market ONE store eyes global alliance to compete with Google*, *supra*.

competing App store, particularly in the United States.[697] An internal Google presentation notes that this form of competition, involving a coalition of carriers, is "[u]nlikely in the US, given market share distribution and competition amongst carriers."[698]

b. Aptoide

311. Aptoide, another App store operating worldwide, assesses a maximum take rate of 25 percent[699] and in some cases charges a take rate as low as ten percent.[700] These take rates encourage developers to steer their customers to Aptoide's lower-cost platform. This strategy has paid off; Aptoide presently has over 300 million users worldwide.[701] Aptoide's growth is nevertheless limited by Google's restrictions—for example, consumers cannot download Aptoide through the Google Play Store and instead must go through the cumbersome side-loading process.[702] Moreover, developers are also barred from any form of steering—that is, informing consumers using the Google Play Store that they can use Aptoide for some or all of their transactions.[703]

c. Amazon

312. Although Amazon's Appstore maintained a "headline" take rate of 30 percent, [redacted] the Amazon Appstore's effective take rate for 2018-2021 on Google Android devices was [redacted] percent.[704] [redacted][705] Amazon

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697. *See, e.g.,* GOOG-PLAY-007315383 ("We take a much needed belt and suspenders approach to our Search and Play contracts to include both OEM's and carriers. In many regions, the carriers drive the preloads for phones and tablets on Android devices."). Carriers knew this. GOOG-PLAY-001055565 ("As we discussed, we are committed to not fragmenting the market. The goal is to use your master, global market to attract developers and publish content…the 'store' or channel they would see is a subset of the market made for them, but the broad market is still available at the same level of access as before."). *See also* GOOG-PLAY-001143425 ("To belay any concerns, we are absolutely not building another market.").

698. GOOG-PLAY-002011285.R at -289.R.

699. *See* Aptoide, *For Developers*, en.aptoide.com/company/developers ("Get a minimum of 75% payout rate on in-App purchases in comparison to 70% or even 50% you get with other App distributors.").

700. *See* Revenue Share, Catappult App Distribution Console, docs.catappult.io/docs/distribution-and-revenue-share.

701. *See* Aptoide, *About Us,* en.aptoide.com/company/about-us ("Aptoide is the game-changing Android App Store. With over 300 million users, 7 billion downloads and 1 million Apps, Aptoide provides an alternative way to discover Apps and games, with no geo-restrictions and one of the best malware detection systems in the market.").

702. Aptoide, *How to download and install Aptoide?,* en.aptoide.com/company/faq/how-to-download-install-aptoide.

703. *See* Google – Play Console Help, *Understanding Google Play's Payments policy*, support.google.com/googleplay/android-developer/answer/10281818?hl=en#zippy=%2Ccan-i-distribute-my-app-via-other-android-app-stores-or-through-my-website%2Ccan-i-communicate-with-my-users-about-alternative-ways-to-pay%2Ccan-i-communicate-with-my-users-about-promotions-on-other-platforms ("Within an app, developers may not lead users to a payment method other than Google Play's billing system unless permitted by the Payments policy. This includes directly linking to a webpage that could lead to an alternate payment method or using language that encourages a user to purchase the digital item outside of the app.").

704. Morrill Dep. 86:16-88:11 (reviewing AMZ-GP_00002471, a spreadsheet showing Amazon Appstore revenue from Android devices).

705. Morrill Dep. 73:5-74:20.

announced in June 2021 that it would reduce its headline take rate from 30 percent to 2[redacted][707] For Google Android devices, after factoring in discounts to developers and consumers, Amazon's take rate was just [redacted] from 2018 – 2021.[708]

313. [redacted][710] Google's 2017 "Amazon Competitor Deep Dive" indicates that Amazon was discounting Amazon Coins up to 15 percent and discounting purchases of In-App Content for Android games up to 30 percent.[711] The Amazon Appstore's consumer subsidies on Google Android devices came to [redacted] percent of consumer expenditure from 2018 – 2021.[712]

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706. Sarah Perez, *Amazon's Appstore lowers its cut of developer revenue for small businesses, adds AWS credits*, TECHCRUNCH (June 17, 2021), techcrunch.com/2021/06/17/amazons-Appstore-lowers-its-cut-of-developer-revenue-for-small-businesses-adds-aws-credits/.

707. [redacted]

708. [redacted] question is relative to non-Amazon produced mobile devices running Android, that is represented by the 3P line.")

709. [redacted]

710. *Id.* Mr. Morrill confirmed that Amazon Coin subsidies are funded by Amazon. *Id.* at 91:4-11.

711. GOOG-PLAY-000879194.R at -204.R.

712. [redacted] *See also* Part VII.C below.

[redacted][713]

d. PC Game Platforms

314. Despite not being a participant in the Android App Distribution Market, video game distribution platforms on PCs are similar to mobile App distribution platforms in that they also connect developers of software applications to consumers without requiring a particular console (like an Xbox or PlayStation).[714] The three dominant platforms through which PC games are bought and sold are Steam, Epic, and Microsoft.[715] Indeed, Google has noted that a 20 percent take rate would bring "Play rev share in line with upper end of desktop gaming stores."[716] The Epic Games Store was launched in December 2018 with a take rate of 12 percent.[717] Microsoft announced a reduction from 30 percent to 12 percent for games sold through its store, beginning August 1, 2021.[718] Effective October 2018, Steam also announced a take-rate reduction from 30 percent to a tiered system: 30 percent for the developer's first $10 million in revenue, 25 percent for sales between $10 and $50 million, and 20 percent for sales more than $50 million.[719] Discord, a PC game platform monitored by Google, imposes a ten percent revenue share.[720]

e. PC App Stores

315. Effective August 1, 2021, Microsoft charged a 12 percent take rate for consumer non-game Apps sold in the Microsoft Store (on devices other than Xbox and those using Windows 8), reduced from 15 percent.[721] Importantly, these commissions only apply when the developer is

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713. AMZ-GP_00002484, at 2488.

714. Take rates for video games played on consoles such as Xbox and Playstation may reflect the cost recovery of the hardware.

715. Steam is estimated to control roughly three quarters of PC gaming sales, followed by Epic (between two and 15 percent) and Microsoft. *See, e.g.,* Kyle Orland, *Humble Bundle creator brings antitrust lawsuit against Valve over Steam*, ARS TECHNICA (Apr. 30, 2021), arstechnica.com/gaming/2021/04/humble-bundle-creator-brings-antitrust-lawsuit-against-valve-over-steam/.

716. GOOG-PLAY-000542516.R at -529.R.

717. Epic Games, *The Epic Games store is now live* (Dec. 6, 2018), www.epicgames.com/store/en-US/news/the-epic-games-store-is-now-live ("The Epic Games store is now open, featuring awesome high-quality games from other developers. Our goal is to bring you great games, and to give game developers a better deal: they receive 88% of the money you spend, versus only 70% elsewhere. This helps developers succeed and make more of the games you love.").

718. Tom Warren, *Microsoft shakes up PC gaming by reducing Windows store cut to just 12 percent*, THE VERGE (Apr. 29, 2021), www.theverge.com/2021/4/29/22409285/microsoft-store-cut-windows-pc-games-12-percent.

719. Brittany Vincent, *Valve Introduces New Revenue Split Changes For Steam Sales,* VARIETY (Dec. 3, 2018), variety.com/2018/gaming/news/valve-revenue-split-changes-1203078700/.

720. GOOG-PLAY-007329076 at -084.

721. Microsoft Store, *App Developer Agreement Version 8.7* (Effective July 28, 2021), query.prod.cms.rt microsoft.com/cms/api/am/binary/RE4OG2b ("Fifteen percent (15%) of Net Receipts for any Apps (and any In-App Products in such Apps, including) that are not listed in Section 6(b)(iii) below. ii. For all Net Receipts generated on or after August 1, 2021: Twelve percent (12%) of Net Receipts for any Games (and any in-App Products in such Games) that are not listed in Section 6(b)(iii). iii. Thirty percent (30%) of Net Receipts for: 1. all Apps and In-App Products acquired by Customers in the Microsoft Store on an Xbox console and billed to such Customers on a non-subscription basis; 2. all Games (and In-App Products in Games) acquired by Customers in the Microsoft Store on an Xbox console; and 3. all Apps and In-App Products acquired by Customers in the Microsoft Store on Windows 8 devices; or Microsoft Store on Windows Phone 8 devices.").

using the Microsoft commerce platform to "support the purchase of your App or any in-App Products" (analogous to Google's billing system).[722] Also as of August 1, 2021, Microsoft charged a *zero* percent take rate for non-game Apps downloaded through the Windows 11 Store if the developer chose to use its own or a third-party commerce platform to facilitate in-App purchases.[723] More specifically, the Microsoft Store charges game developers 12 percent of revenue; non-game App developers pay 15 percent of revenue if they use Microsoft platform for their in-App transactions, but zero percent if they do not:

> Many developers love the Microsoft Commerce platform because of its simplicity, global distribution, platform integration and its competitive revenue share terms at 85/15 for Apps and 88/12 for games. Starting July 28, App developers will also have an option to bring their own or a third party commerce platform in their Apps, and if they do so they don't need to pay Microsoft any fee. **They can keep 100% of their revenue**."[724]

316. The Microsoft PC App store faces competition from direct downloads—consumers can easily discover a new application on the Internet and download it to the personal computer without using Microsoft as an intermediary. Given the competition from direct App downloads, Microsoft only charges a take rate when it performs the services of matchmaking—connecting the consumer to the app—and billing services are provided.

f. Other Examples

317. Additional examples of take rates more competitive than Google's abound in other, similarly situated industries with two-sided platforms. In independent online publishing, one of the leading platforms, Substack, which brings together writers and readers, takes a ten percent commission from writers, recognizing the low switching costs: "Moving one's email list away from Substack is simple, so the firm lets writers keep 90% of their revenues."[725] This ease of mobility increases writers' elasticity of supply, which puts downward pressure on the take rate. Revue, a competitor to Substack now owned by Twitter, charges only a five percent take rate.[726] Google's Chrome web store, which provides extensions, themes, and Apps associated with its

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722. *Id.* at 13-14 ("Commerce Platform Requirements. Purchases made on a third-party commerce engine are not subject to the Store Fee, but are still required to comply with our Certification Requirement.").

723. Giorgio Sardo, General Manager – Microsoft Store, *Building a new, open Microsoft Store on Windows 11*, MICROSOFT WINDOWS BLOGS (Jun. 24, 2021), blogs.windows.com/windowsexperience/2021/06/24/building-a-new-open-microsoft-store-on-windows-11/.

724. *Id.* (emphasis added); *see also* Alex Hern, *Microsoft to let developers keep all their Windows App store revenue*, THE GUARDIAN (June 25, 2021), theguardian.com/technology/2021/jun/25/microsoft-let-developers-keep-all-windows-app-store-revenue. ("As part of the shift to Windows 11, unveiled on Thursday, the company will allow developers to use their own payment systems on Apps they sell through the Windows store. Those who do will not have to pay a penny to Microsoft."). Thus far, Microsoft has declined to unbundle its billing system for game developers: "A different set of rules apply for game developers: their share is lower, at 12%, but they will not be given the option of using their own payment processors." *Id.*

725. The Economist, *The new rules of the 'creator economy'*, (May 8, 2021), economist.com/briefing/2021/05/08/the-new-rules-of-the-creator-economy.

726. Max Willens, *Cheat sheet: Twitter's acquisition of Revue heats up the battle of the inbox*, DIGIDAY (Jan. 27, 2021), digiday.com/media/cheat-sheet-twitters-acquisition-of-revue-heats-up-the-battle-of-the-inbox/ ("Revue will remain a separate brand, but Twitter will provide the resources to make Revue more competitive with other newsletter platforms; the commission Revue takes on all consumer revenue has been reduced to 5%, half of what Substack charges. All of the Pro features for Revue will be freely available to all Revue users as well. Twitter will also help Revue hire more people across research, design and engineering.").

browser, charges a five percent take rate, recognizing the value of attracting developers who might otherwise produce content for other browsers.[727] Take rates for online retail from vendors such as Amazon, eBay, and Etsy range from eight to fifteen percent with a small additional lump sum on the order of $0.30-$0.99.[728]

318. Table 7 offers a non-comprehensive summary of take rates in comparable competitive digital platform environments. Google's competitive but-for take rate from my two-sided platform model of [redacted] percent is corroborated by rates charged by competitive mobile App stores (18 to 25 percent), and is conservative compared to the take rates imposed by other platforms in more competitive industries. Finally, take rates of 15 percent [redacted] offered by Google pursuant to LRAP (and similar programs) also provide a reasonable approximation of the but-for take rate. Record evidence shows that LRAP offered a 15 percent take rate to induce premium subscription video streaming services with viable non-Google billing options (such as [redacted] and others) to adopt Google Play Billing in their Apps.[729] It therefore provides a valid competitive benchmark take rate for developers with take rates at (or close to) Google's standard 30 percent take rate in the actual world (that is, the vast majority of developers).

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727. D. Melanson, *Google makes Chrome Web Store available worldwide, adds in-App purchases and flat five percent fee,* ENGADGET (May 11, 2011), www.engadget.com/2011-05-11-google-makes-chome-web-store-available-worldwide-adds-in-app-pu html.

728. *See, e.g.,* Hung Truong, *Compare 9 Online Marketplace Fees* (Sept. 18, 2018), sellerzen.com/compare-9-online-marketplace-fees.

729. GOOG-PLAY-000578299.R at -301.R. *See also* Defendants' Responses and Objections to Developer Plaintiffs' First Set of Interrogatories at 13 ("Google maintains several developer programs that lower the service fee earned by Google on Apps and in-App purchases distributed by those developers on Google Play. Programs that U.S. developers participate in include "Living Room Accelerator Program" ("LRAP"), LRAP++, Audio Distribution Accelerator Program ("ADAP"), and Subscribe with Google ("SwG").") Google created LRAP for developers "who had video subscription Apps" to encourage them to help "build up [Google's] android living room experience," including to integrate a product known as "Cast" into their mobile Apps which "would then allow their content to be seen on TVs" and to integrate with Google Play billing. *See* Rosenberg Dep. 261:11-262:4. Google offered a [redacted] percent take rate to induce premium subscription video streaming developers such as [redacted] and others to adopt Google's billing products in their Apps. *See, e.g.,* GOOG-PLAY-000338849.R at -888.R; GOOG-PLAY-004714797; GOOG-PLAY-004717237; Defendants' Responses and Objections to Developer Plaintiffs' First Set of Interrogatories at 14-15; GOOG-PLAY-0006998204.R at -206.R. Further, under the LRAP++ program, Google has offered take rates of [redacted] (*see* GOOG-PLAY-000442329 at -345—346; GOOG-PLAY-004717237) and [redacted] (see GOOG-PLAY-000338849.R at -888.R; GOOG-PLAY-006998204.R at -206.R).

TABLE 7: BENCHMARK TAKE RATES

Category	Benchmark		Comparable Take Rate
Mobile App Stores	(1)	Aptoide	10-25%
	(2)	ONE Store	5-20%
	(3)	Amazon	18%
PC App Stores	(4)	Microsoft (non-games)	12-15%
PC Games	(5)	Steam (Valve)	20-30%
	(6)	Epic	12%
	(7)	Microsoft Store	12% effective 8/1/2021
Online Retail	(8)	Amazon	8-15% + $0.99/item or $39.99/month
	(9)	eBay	12.55% + $0.35
	(10)	Etsy	8% + $0.45
	(11)	Google	0% (previously 5-15%)
	(12)	Poshmark	20% (for over $15, $2.95 flat fee for under $15 sale)
	(13)	Walmart	6-15%
Online Publishing	(14)	Substack	10% + credit card fee
	(15)	Revue (Twitter)	5%

Sources: (1) Aptoide – Catappult, *Revenue Share*, docs.catappult.io/docs/distribution-and-revenue-share (2) Kim Eun-jung, *Korean App market ONE store eyes global alliance to compete with Google, supra*; GOOG-PLAY-007329076 at -084 (showing a 20 percent take rate, originally at 30 percent); (3) Derek Strickland, *Apple's 30% App Store commission is 'supracompetitive,' court declares*, TWEAKTOWN (Sept. 11, 2021), tweaktown.com/news/81567/apples-30-app-store-commission-is-supracompetitive-court-declares/index.html. (showing Amazon's effective take rate of 18.1%); (4) Microsoft Store, App Developer Agreement Version 8.7, *supra;* (5) Brittany Vincent, *Valve Introduces New Revenue Split Changes For Steam Sales*, *supra*; (6) Epic Games, *The Epic Games store is now live*, *supra*; (7) Tom Warren, *Microsoft shakes up PC gaming by reducing Windows store cut to just 12 percent*, *supra*; (8) Amazon, *Let's talk numbers*, sell.amazon.com/pricing; (9) eBay, *Understanding selling fees*, pages.ebay.com/seller-center/get-started/seller-fees.html; (10) Etsy, *Sell*, www.etsy.com/sell (Etsy charges a $0.20 listing fee. When a product is sold, they charge a 5% transaction fee, paired with a 3% + $0.25 payment processing fee); (11) Google Merchant Center Help, *New 0% commission fee for selling on Google through Shopping Actions in the US* (July 23, 2020), support.google.com/merchants/answer/9977875?hl=en; Bryan Falla, *Google Shopping Actions Commission Rates*, GODATAFEED (Oct. 22, 2019), godatafeed.com/blog/google-shopping-actions-commission-structure; (12) Poshmark, *What are the fees for selling on Poshmark*, support.poshmark.com/s/article/297755057?language=en_US; (13) Walmart Marketplace, *Referral Fees*, marketplace.walmart.com/referral-fees/; (14) Substack, *Going Paid*, substack.com/going-paid; (15) Tom McKay, *Twitter Wants to Be Substack Now*, GIZMODO (Jan. 26, 2021), gizmodo.com/twitter-wants-to-be-substack-now-1846136057.

C. Removing Google's In-App Aftermarket Restrictions Would Put Downward Pressure on the Take Rate Google Imposes on Developers for In-App Content

319. Relative to the value provided by the developer, the value that the Play Store contributes by matching a consumer with an App dissipates over time. That is because once a consumer has found an App on the Play Store, the match has been made. Any value added through

the purchase of In-App Content is added entirely by the developer. Google's own documents recognize this.[730]

320. I understand that all of the In-App Aftermarket services that developers are currently forced to use from Google (owing to Google's In-App Aftermarket restrictions) can actually be performed by a third party or the developer itself completely independently of Google. For example, there exists a well-established industry of competitive payment processors in the business of facilitating online transactions.[731]

321. In the competitive but-for world without Google's restrictions, developers could choose their own provider of services in the In-App Aftermarket. Alternatively, developers would be able to offer consumers the choice of selecting from an array of competitive options to provide In-App Content.[732] Elementary economics dictates that this would place downward pressure on Google's take rate, pushing it closer to the marginal cost of providing any services associated with In-App Content. Developers having the ability to steer consumers to lower-cost competitors would reinforce this downward pressure, an outcome that Google has modeled in Project Basecamp.[733] I use standard economic methods to conservatively estimate the extent to which Google's take rate for services in delivering In-App Content would fall when Google's restrictions are removed.

1. A Standard Economic Model of Competition in the In-App Aftermarket

322. To the extent that a competitive In-App Aftermarket would be characterized by homogenous commodity services (payment for and distribution of In-App Content) offered by various competitive rivals with few barriers to entry or expansion, standard economic principles prescribe that Google would be unable to charge a premium for these services.[734] If Google attempted to charge developers anything in excess of the competitive market price for In-App Aftermarket services, then developers would switch to a competitor providing identical services at lower cost, rendering Google's attempted price increase unprofitable.[735] Thus, to the extent that

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730. *See, e.g.,* GOOG-PLAY-003335786.R at -805.R (describing Google's declining contribution to perceived value over time as applied to games).

731. *See, e.g.,* Rob Clymo, Brian Turner, and Jonas DeMuro, *Best payment gateways of 2022*, TECH RADAR (Aug. 22, 2022), www.techradar.com/best/best-payment-gateways; *see also* Table 10 below (listing various competitive payment processors).

732. To comply with recent legislation in South Korea, the Play Store now allows developers to offer South Korean users the choice between Google Play Billing and alternative in-app billing systems. Whenever a user selects an alternative billing system, the take rate for that transaction is reduced by four percentage points. *See, e.g.,* Play Console Help, *Changes to Google Play's billing requirements for developers serving users in South Korea*, support.google.com/googleplay/android-developer/answer/11222040. This is not a competitive market outcome, and instead reflects Google's ongoing monopoly power, through which Google has effectively replicated the Aftermarket Tie-In, by maintaining a high take rate in the In-App Aftermarket even when an alternative billing system is used. The same holds for Google's recent initiative to introduce user choice billing in European Economic Area countries, Australia, India, Indonesia, and Japan. *See* Abner Li, *Google Play opens developer sign-ups for third-party 'User Choice Billing'*, 9TO5 GOOGLE (Sep. 1, 2022), 9to5google.com/2022/09/01/google-play-user-billing-sign-up/. It would be economically irrational for Google to voluntarily relinquish its monopoly power and the profits that come with it.

733. *See* Part VI.D.2 below; *see also* GOOG-PLAY-006829073.R at GOOG-PLAY-006829085.R (assessing "Dev incentive to steer user choice").

734. *See, e.g.,* MANKIW at 268-284.

735. *Id.*

the competitive In-App Aftermarket is characterized by competition for a commoditized service, Google's equilibrium take rate in the In-App Aftermarket would fall towards the marginal cost of serving that market. As explained below, my economic model of the In-App Aftermarket conservatively allows Google to charge a substantial markup above marginal cost, even in a more competitive world.

323. Record evidence shows that Google's 30 percent take rate in the In-App Aftermarket cannot be justified by the costs of serving that market. As early as 2009, Google recognized that "30% is an arbitrary fee > the transaction cost to GOOG (2%)" and noted that "in competitive landscape may drive developers away from platform."[736] In another document, Google contemplated consumers choosing a competitive payment processor, described the "Core Issue [:] 30% is too high,"[737] and showed "market rates" for payment processing, including "PSPs [Payment Service Providers] that focus on simplicity and ease of integration," such as Stripe and PayPal, which charged "30c + 2.9%."[738] The same Google document calculated Google's average cost of payment processing at just [redacted] percent of customer spend for the top 5,000 developers. Google's estimate of its own payment-processing costs are below corresponding charges for two competitive payment processors (Stripe and Adyen).[739] Another Google document reports that transaction costs came to [redacted] percent of consumer spend in the first five months of 2021.[740]

324. Financial data produced by Google allow me to estimate the Play Store's global transaction costs as a percentage of global customer spend in the In-App Aftermarket and the Android App Distribution Market (Google's financial data do not distinguish between the two markets).[741] Even if I conservatively include all the direct costs of sales that Google records for the Play Store (excluding irrelevant content costs for movies, television, and books), as well as all direct operating expenses, I calculate all of these costs came to [redacted] percent of consumer expenditures on the Play Store for the period 2016 – 2021.[742] Accordingly, Google's cost of providing In-App Aftermarket services can be conservatively estimated at [redacted] percent of consumer expenditures.[743] This implies that Google's standard 30 percent take rate vastly exceeds

736. GOOG-PLAY-004630018.R at GOOG-PLAY-004630024.R.

737. GOOG-PLAY-006829073 at GOOG-PLAY-006829079.

738. GOOG-PLAY-006829073.R at GOOG-PLAY-006829097.R.

739. *Id.* at GOOG-PLAY-006829076.R (showing Google's average [redacted] percent of consumer spend, compared with 3.1 percent for Ayden and 6.2 percent for Stripe. These calculations exclude DCB [Direct Carrier Billing] and GC [Google Cloud]). When DCB and GC are included, Google estimates that its payment processing costs are [redacted] for 2,300 out of the top 5,000 developers, and [redacted] for the vast majority of developers. *Id.* at GOOG-PLAY-006829075.R.

740. GOOG-PLAY-007617587 ("Summary" tab); *see also* "FOP Cost Rates by country" tab (showing country blended rate of [redacted] percent for the United States).

741. *See, e.g.,* GOOG-PLAY-000416245. Because these are global financial data, they are not comparable to the revenue statistics in Table 6 above and in Table 8 below, which are limited to the United States.

742. In addition to Transaction Fees, the Play Store's Direct Costs of Sales includes Content Costs, Customer Support, and Other. I include all of these except Content Costs; these are costs Google incurs for sales of books, movies, and television, and are not part of the relevant markets here. I also include all Direct Operating Expenses, which include Payroll & Stock-based Comp (SBC), as well as the following Non-Payroll costs: Prof Services, A&P, Equipment, and Other (T&E, Office & Related). *See* work papers for this report.

743. Google's cost of providing In-App Aftermarket services is certainly no more than fifteen percent of consumer expenditures, the rate that Google charges to all subscription Apps, effective January 1, 2022. *See* Samat, *Evolving our business model to address developer needs, supra* ("To help support the specific needs of developers

even a conservatively high estimate of its marginal costs [redacted] percent of revenues), confirming that Google is exercising market power.

325. Google may argue that it would have retained some brand loyalty in the In-App Aftermarket, conferring a degree of pricing power in a competitive world, and thus a deviation from homogenous-product competition contemplated above. In that case, standard economics shows that Google's profit-maximizing price for In-App Aftermarket services would be determined by Google's firm-specific price elasticity of demand (as well as marginal costs).[744] The firm-specific demand elasticity is the percentage decrease in demand for Google's In-App Aftermarket services resulting from a one percent increase in price.[745] Google's profit-maximizing price for In-App Aftermarket services is given by the standard inverse elasticity formula, shown in the equation below.[746]

$$(P-C)/P = 1/E_g \tag{V.9}$$

where E_g represents Google's firm-specific demand elasticity for In-App Aftermarket services, P represents the price for In-App Aftermarket services, and C represents Google's marginal cost of providing In-App Aftermarket services. It bears noting that this elasticity of demand for Google's In-App Aftermarket services (Google Play Billing) is different from the elasticities of demand used in the two-sided model of the Android App Distribution Market for the Play Store.

326. As explained in Landes and Posner's seminal paper, Google's firm-specific demand elasticity is related to the market demand elasticity as follows:[747]

$$E_g = E_M / S_g + E_s \left(1 - S_g\right) / S_g \tag{V.10}$$

Above, E_M is the market demand elasticity for In-App Aftermarket services—that is, the percentage decrease in the market-wide quantity demanded resulting from a one percent market-wide increase in price. The term E_s is the elasticity of supply of Google's rivals—that is, the percentage increase in the quantity supplied by Google's rivals, given a one percent increase in Google's price. Finally, S_g is Google's market share. For example, if Google's market share is 100 percent (S_g =1), the equation collapses to $E_g = E_M$. In that scenario, Google's firm-specific elasticity is the same as the market elasticity, because Google would be a monopolist (in the strict economic sense of being literally the only supplier). In contrast, when Google's market share falls below 100 percent, its firm-specific demand elasticity exceeds the market demand elasticity. By the standard inverse-elasticity formula in equation V.9 above, Google's profit-maximizing price under competition is lower than the monopoly price for In-App Aftermarket services.

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offering subscriptions, starting on January 1, 2022, we're decreasing the service fee for all subscriptions on Google Play from 30% to 15%, starting from day one.").

744. *See, e.g.,* Landes & Posner at 939-940.

745. *Id.*

746. *Id. See also* Jerry Hausman & Greg Leonard, *Efficiencies from the Consumer Viewpoint,* 17(3) GEORGE MASON LAW REVIEW 707, 709 (1999) [hereafter Hausman & Leonard].

747. Landes & Posner at 944-945.

327. In the actual world, Google's share of the In-App Aftermarket is close to 100 percent,[748] because Google has prevented competitive entry by forcing developers to purchase from Google In-App Aftermarket services (authorization of In-App Content and payment processing), typically priced at 30 percent of developers' In-App Aftermarket revenue. In a competitive but-for world, elementary economic principles dictate that competitors would enter the market and charge a lower take rate to developers, diverting business from Google and pushing Google's price downward toward marginal cost.[749]

328. Economists have demonstrated empirically that previously monopolistic (or dominant) firms faced with competitive entry lose both market share and pricing power. For example, when AT&T lost its monopoly in long-distance telephone service pursuant to a 1982 divestiture order, it lost substantial market share, and long-distance telephone prices fell substantially, despite any brand loyalty that AT&T may have enjoyed over other long-distance entrants such as MCI.[750] In an article published in the *Journal of Law & Economics*, the authors found that AT&T, which had previously enjoyed a government-sanctioned monopoly, saw its market share decline to approximately 60 percent by the early 1990s.[751] The supply elasticity of AT&T's competitors was estimated at 4.38, consistent with evidence that barriers to entry and expansion in the long-distance market were relatively low during the post-divestiture period.[752] Applying equation V.10 above, the authors calculated that AT&T's firm-specific demand elasticity at between 3.73 and 7.81, which implied price-cost markups of between 13 and 29 percent.[753] These markups are below those found in a range of other industries throughout the economy, indicating that competition had substantially eroded AT&T's market power in the interstate long-distance market.[754] In the absence of competition, AT&T's profit-maximizing prices for long-distance service would have been substantially higher, particularly given that market demand for long-distance service is relatively insensitive to price.[755]

329. Similarly, an econometric analysis of the historically dominant Aluminum Company of America (Alcoa) found that Alcoa's pricing power declined significantly in the

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748. *See, e.g.*, Samat, *Listening to Developer Feedback to Improve Google Play*, *supra* ("Less than 3% of developers with Apps on Play sold digital goods over the last 12 months, and of this 3%, the vast majority (nearly 97%) already use Google Play's billing. But for those who already have an App on Google Play that requires technical work to integrate our billing system, we do not want to unduly disrupt their roadmaps and are giving a year (until September 30, 2021) to complete any needed updates. And of course we will require Google's Apps that do not already use Google Play's billing system to make the necessary updates as well.").

749. *See, e.g.*, MANKIW at 270-282.

750. *See, e.g.,* Simran Kahai, David Kaserman & John Mayo, *Is the "Dominant Firm" Dominant? An Empirical Analysis of AT&T'S Market Power*, 39 JOURNAL OF LAW & ECONOMICS 499-517 (1996) [hereafter Kahai et al.]. *See also* Jeffrey Eisenach and Kevin Caves, *What Happens When Local Phone Service Is Deregulated?* REGULATION 34-41 (2012) at 35 ("There is no disagreement, however, that long distance prices have fallen sharply since liberalization. As shown in Figure 1, in real terms, the price of long-distance service fell by more than 70 percent between 1984 and 2006.").

751. Kahai et al. at 510. This reflects AT&T's output-based market share. Its asset-based market share was even lower, at approximately 40 percent. *Id.*

752. *Id*. at 508.

753. *Id*. at 510 ("The corresponding values of the Lerner index…are 0.29 and 0.13.").

754. *Id.* at 510-513.

755. *Id*. at 509 (reporting market demand elasticities between 0.49 and 0.75).

postwar period, despite substantial barriers to entry and expansion by competitive rivals.[756] The authors estimated the supply elasticity for Alcoa's rivals in the aluminum industry at just 1.4.[757] This was indicative of the substantial capital requirements for primary aluminum producers,[758] and particularly the "extraordinarily high" cost of entry at an efficient scale.[759] Nevertheless, Alcoa's residual demand elasticity was estimated at 8.3, indicating that Alcoa's pricing power, much like AT&T's, had substantially eroded.[760] The authors used the same formula given in equation V.10 above to estimate Alcoa's residual demand elasticity: The market demand elasticity for aluminum was estimated at 2.0.[761] Alcoa's capacity-based market share was approximately 35 percent during the relevant time period.[762] Applying equation V.10, this resulted in a relatively high firm-specific elasticity for Alcoa of 8.3.[763] This relatively high price sensitivity yields a correspondingly low price-cost markup of 12 percent.[764] The authors concluded that, despite the supply constraints faced by Alcoa's rivals, "the aluminum industry has entered a much more competitive market structure in the post-war period."[765] In the absence of competitive entry, Alcoa would have been able to command price-cost markups of approximately 50 percent (equal to $1/E_M = 1/2.0$) rather than 12 percent.

330. I apply this same standard economic framework developed by Landes and Posner (the "Landes-Posner Model") to modeling the but-for take rate in the In-App Aftermarket. These calculations are summarized in Table 8. As seen below, U.S. consumer expenditures in the In-App Aftermarket came to [redacted] between mid-August 2016 (the beginning of the Class Period) and the end of May 2022. Over this timeframe, Google collected [redacted] in U.S. commissions, resulting in a take rate in the actual world of [redacted] percent. Total U.S. transaction volume was [redacted] implying an average consumer price per transaction of [redacted] Google received [redacted] per transaction. Google's marginal cost per transaction is conservatively estimated at [redacted] percent of the average consumer price, or [redacted] per transaction, which yields a markup of price over cost of [redacted] percent. By the equation (V.9) above, Google's own-firm elasticity is [redacted] By equation (V.10) above, the market demand elasticity is [redacted] The values of these inputs in the actual world are summarized in the first panel of Table 8 below.

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756. Sheng-Ping Yang, *Identifying a dominant firm's market power among sellers of a homogeneous product: an application to Alcoa*, 34 APPLIED ECONOMICS 1411-1419 (2002).
757. *Id.* at 1416.
758. *Id.* at 1412.
759. *Id.* at 1418.
760. *Id.* at 1417.
761. *Id.* at 1416.
762. *Id.* at 1417.
763. Equal to 2.0/0.35 + 1.4*(1 - 0.35)/0.35.
764. Equal to 1/8.3 = 0.12.
765. *Id.* at 1418.
766. Average revenue is mathematically equivalent to price per unit. *See, e.g.,* MANKIW at 270 ("Average revenue is total revenue (P x Q) divided by the quantity (Q). *Therefore, for all types of firms, average revenue equals the price of the good.*") (emphasis in original).
767. In the actual world, $E_s = 0$ because competitive rivals are constrained by Google's restrictions. Therefore, $E_M = E_g S_g$. *See, e.g.,* MICHAEL KATZ AND HARVEY ROSEN, MICROECONOMICS 3rd ed. 329-330 (Irwin/McGraw-Hill 1998).

TABLE 8: IN-APP AFTERMARKET IMPACT & DAMAGES (U.S., 8/16/2016 – 5/31/2022)

Actual World			
#	**Description**	**Value**	**Source/Notes**
[1]	Consumer Expenditure (US; Before Discounts)	[redacted]	GOOG-PLAY 005535886; Google Transaction Data (US Consumers)
[1a]	Consumer Expenditure (US; Net of Discounts)		*Id.*
[2]	Google Revenue (US; Before Discounts)		*Id.*
[2a]	Google Revenue (US; Net of Discounts)		*Id.*
[3] = [2]/[1]	Google Take Rate		Calculated
[4]	Quantity (Transactions)		GOOG-PLAY 005535886; Google Transaction Data (US Consumers)
[5] = [1a]/[4]	Consumer Price Per Transaction (Net of Discounts)		Calculated
[6] =[2a]/[4]	Google Price Per Transaction (Net of Discounts)		Calculated
[7] = 0.0985*[5]	Google Marginal Cost Per Transaction		Play Financials (equal to [redacted] percent of consumer expenditure. Includes all direct COS & Direct OpEx)
[8] = ([6] - [7])/[6]	Google Price-Cost Margin		Calculated
[9] = 1/[8]	Google Own-Firm Demand Elasticity		Calculated
[10]	Google Market Share		*See, e.g.*, https://android-developers.googleblog.com/2020/09/listening-to-developer-feedback-to.html
[11] = [10]*[9]	Market Demand Elasticity		Calculated
Absent Google's Restrictions			
#	**Description**		**Source/Notes**
[12]	Google Market Share		Economic principles/empirical studies
[13]	Competitor Supply Elasticity		Economic principles/empirical studies
[14] = [11]/[12] + [13]*(1 - [12])/[12]	Google Own-Firm Demand Elasticity		Calculated
[15] = 1/[14]	Google Price-Cost Margin		Calculated
[16] = [7]/(1 - [15])	Google Price Per Transaction		Calculated
[17] = [6] - [16]	Total Savings Per Transaction		Calculated
[18]	Pass-Through Rate		Estimated (See Table 13)
[19] = [18]*[17]	Consumer Savings Per Transaction		Calculated
[20] = [5] - [19]	Consumer Price Per Transaction		Calculated
[21] = [16]/[20]	Google Take Rate		Calculated
[22] = [4]*[19]	**Aggregate Damages**		Calculated

Notes: See notes for Table 6, *supra*.

331. The values for the parameters in the competitive but-for world are summarized in the second panel of Table 8 above. Even in the presence of substantial competition, I assume conservatively that Google would have retained a substantial market share of 60 percent. As noted above, this was approximately AT&T's market share in the long-distance market after competitive

entry.[768] It is also substantially above Alcoa's market share after competitive entry by capacity-constrained rival aluminum manufacturers (approximately 35 percent).[769] This estimate is also conservative in relation to market share and concentration statistics for e-commerce markets, in which the payment method is generally not tied to the rest of the transaction: There exists a range of payment methods accepted in U.S. e-commerce markets, from credit and debit cards (Visa, Mastercard, etc.) to digital wallet services (such as Amazon Payments, PayPal, Square, and others).[770] Credit and debit cards account for approximately 58 percent of e-commerce transactions; the second largest payment method is digital wallets, at 25 percent.[771] Visa, the largest credit and debit platform, has a market share of 60 percent.[772] Visa's share of e-commerce payments can therefore be estimated at approximately [58 percent] x [60 percent] = 35 percent. Within the second largest category (digital wallet services), the largest firm is PayPal, with a market share of approximately 55 percent.[773] PayPal's share of e-commerce payments can therefore be estimated at approximately [55 percent] x [25 percent] = 13.75 percent.[774] Thus, my analysis assumes that, in a more competitive world, Google would command a substantially greater market share than Visa or PayPal in e-commerce.

332. In the instant case, the elasticity of supply of Google's would-be rivals in the market for In-App Aftermarket services cannot be measured directly, because Google has foreclosed entry and expansion by rivals. In Table 8 above, I set E_s = 4.38, based on the supply elasticity for AT&T's long-distance competitors estimated econometrically in the literature.[775] Using equation V.10, Google's competitive own-firm demand elasticity for In-App Aftermarket services can now be calculated at [redacted] which implies a but-for price-cost margin of [redacted] percent, as seen in Table 8 above. This competitive price-cost margin is well within the range of AT&T's price-cost margins after entry by long-distance competitors (between 13 and 29 percent),[776] and above Alcoa's post-

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768. Kahai et al., *supra*, at 510. This reflects AT&T's output-based market share. Its asset-based market share was even lower, at approximately 40 percent. *Id.*

769. Yang, *supra,* at 1417.

770. J.P. Morgan, *E-commerce Payments Trends: United States* (2019), jpmorgan.com/merchant-services/insights/reports/united-states

771. The remainder was accounted for by bank transfers and other methods. J.P. Morgan, *2020 E-commerce Payments Trends Report: US*, jpmorgan.com/merchant-services/insights/reports/united-states-2020. *See also* D. Tighe, *Distribution of e-commerce payment methods in the United States in 2020*, STATISTA, statista.com/statistics/935676/payment-methods-used-for-online-transactions-usa/ (showing credit cards at 30 percent of e-commerce payments, debit cards at 21 percent, and digital wallets at 30 percent).

772. *See, e.g.,* Lewis Krauskopf, *Swiping their way higher: Visa, Mastercard could be the next $1 trillion companies*, REUTERS (January 31, 2020), reuters.com/article/us-visa-mastercard-stocks/swiping-their-way-higher-visa-mastercard-could-be-the-next-1-trillion-companies-idUSKBN1ZU0JA ("Visa holds a 60% share of the credit and debit card market[.]"). *See also* Julija A., *US Credit Card Market Share: Facts and Statistics,* FORTUNLY (November 23, 2021), fortunly.com/articles/credit-card-market-share/.

773. *See, e.g.,* Douglas Karr, *PayPal Market Share Statistics And Its History of Dominating Online Payment Processing*, MARTECH ZONE (Aug. 3, 2020), martech.zone/paypal-statistics-online-payments/.

774. PayPal's overall online market share has been independently estimated at 14 percent. *See* Stephanie Chevalier, *Which form of payment do you use most often for online shopping?*, Statista, statista.com/statistics/448712/online-shopping-payment-method-preference-usa/. *See also* Douglas Karr, *PayPal Market Share Statistics And Its History of Dominating Online Payment Processing*, MARTECH (Aug. 3, 2020), martech.zone/paypal-statistics-online-payments/ ("18% of all e-commerce is processed by PayPal[.]").

775. Kahai et al. at 508.

776. *Id.* at 510 ("The corresponding values of the Lerner index…are 0.29 and 0.13.").

entry price cost margins of 12 percent.[777] Google's price to developers would fall to [redacted] per transaction in such a competitive but-for world, resulting in total savings of [redacted] per transaction relative to the actual world. In Part VI.D below, I estimate that developers would pass on approximately 91.1 percent of these savings to consumers; accordingly, aggregate damages to consumers in the In-App Aftermarket come to [redacted] over the time period from 8/16/2016 through 5/31/2022 for the U.S.[778] As seen above, Google's take rate would fall to [redacted] percent in this competitive but-for world, which would still afford Google a significant margin on the transactions in the In-App Aftermarket that it retains (Google's price-cost margin would be [redacted] percent, as shown in Row 15 of Table 8 above).

2. Analysis of Similar Platforms Corroborates My Competitive Take Rate In the In-App Aftermarket

333. Following the *Epic v. Apple* ruling that Apple must permit App developers to steer consumers to other payment processing systems, the third-party payment processing firm Paddle announced its pricing structure for Apple's App Store.[779] In addition to providing a suite of merchant services that Apple does not, Paddle offers a ten percent take rate for any transactions under $10, and a five percent take rate plus $0.50 for transactions over this amount. [780] As shown below, if Paddle were to provide the same services to developers on the Play Store at such rates, developers would be unequivocally better off. This includes developers selling low-priced Apps (below $10), as they would pay only a ten percent transaction fee with no fixed component.

TABLE 9: TAKE RATES FOR APPLE APP STORE, THE PLAY STORE, AND PADDLE

	App Store	**Play Store**	**Paddle**
Transactions below $10	15-30%	15-30%	10%
Transactions from $10+	15-30%	15-30%	5% + $0.50

Source: *In-App Purchase*, PADDLE, paddle.com/platform/in-app-purchase

334. [redacted]

777. Yang, *supra*, at 1417 ("Alcoa's residual demand elasticity is -8.3382. Then, the corresponding value of the Lerner index is 0.1199…").
778. In the event that proof of pass-through is not necessary under the law, I have been asked to calculate damages based on the full reduction in the take rate in the but-for world. I do so in Part VII.A below.
779. Chance Miller, *Paddle unveils 'first alternative' to Apple's App Store In-App Purchase system following Epic ruling*, 9TO5MAC, (Oct. 7, 2021), 9to5mac.com/2021/10/07/app-store-iap-paddle-system-announcement/.
780. *In-App Purchase*, PADDLE, paddle.com/platform/in-app-purchase.
781. The Paypers, *Coda Payments partners Riot Games for payments services across Southeast Asia,* (May 4, 2020), thepaypers.com/ecommerce/coda-payments-partners-riot-games-for-payments-services-across-southeast-asia--1242106.
782. EPIC_GOOGLE_01747963; EPIC_GOOGLE_01747440.

[redacted]

783. *See, e.g.*, Jason Vissers, *How much does PayPal charge?*, Merchant Maverick (Jul. 8, 2022), merchantmaverick.com/the-complete-guide-to-paypals-fees-rates-and-pricing/ ("PayPal offers its Micropayments plan to certain merchants with an average transaction size under $10…These merchants will pay 4.99% + $0.09 for low-value transactions, with the lower fixed fee more than making up for the higher percentage fee."). *See also* Lisa Gennaro, "Stripe vs PayPal – Which One Is Better? (Pros and Cons)," (June 24, 2022) wpforms.com/stripe-vs-paypal-which-one-is-better/ (listing, for micropayments below $10, Stripe fees of "5% + 10¢" and PayPal fees of "5% + .05¢").

784. As explained in the previous section, my analysis incorporates Google's financial information to account for the possibility that Google incurs additional marginal costs, beyond payment processing. Specifically, I conservatively include all direct costs recorded in GOOG-PLAY-000416245 (with the exception of content costs, which are irrelevant).

TABLE 10: PAYMENT PROCESSORS AND THEIR TAKE RATES[785]

	Payment Processor	Example Clients	Take Rate
(1a)	PayPal	American Airlines, eBay, Facebook, Spotify	3.49% + $0.49
(1b)	PayPal Business	Businesses with micropayments	4.99% + $0.09
(2)	Stripe	Lyft, Under Armour, Blue Apron, Pinterest	2.9% + $0.30
(3)	Amazon Pay	Zuora, Shopify, BigCommerce, Magento	
(4)	Braintree*	Uber, StubHub, Dropbox, Yelp	2.59% + $0.49
(5)	Square	Shake Shack, Postmates, Craver	2.6% + $0.10; 2.9% + $0.30†
(6)	Clover	Verizon Business	2.3-2.6% + $0.10
(7)	Authorize.net	TRX Cymbals, Prism Kites	2.9% + $0.30
(8)	Vanco	Churches and public schools	2.9% + $0.45; 2.65% + $0.39††
(9)	Fattmerchant	Lens Crafters, Jimmy Johns, Meineke, Maserati	$99 - $199/month + $0.06 - $0.15 per transaction†††
(10)	Adyen	Booking.com, McDonalds, Spotify, Microsoft	€0.10 + 1-5%††††
(11)	Google Pay**	Burger King, Dunkin Donuts, Target, Doordash	2.9%
(12)	Apple Pay	Best Buy, Taco Bell, Walgreens, Kohl's	3.0%

Notes: Take rates are based on fees for credit card usage. * Owned by PayPal. ** Not to be confused with Google Play Billing. † Square charges 2.6% + $0.10 for in-person swipes and 2.9%

785. *Sources*: (1) Drew Strojny, *Stripe vs PayPal: Who should you choose?*, MEMBERFUL (Jan. 10, 2016), memberful.com/blog/stripe-vs-paypal/; Amanda Swan, *Which online stores accept PayPal?*, FINDER (Dec. 28, 2020), finder.com/paypal-store-list ; (1b) Jason Vissers, *How much does PayPal charge?*, Merchant Maverick (Jul. 8, 2022), merchantmaverick.com/the-complete-guide-to-paypals-fees-rates-and-pricing/ ; (2) Drew Strojny, *Stripe vs PayPal: Who should you choose?*, *supra*; Amanda Swan ; Frank Kehl, *How Does Stripe Work? The Complete Guide to Stripe for Business*, MERCHANT MAVERICK (Jun. 28, 2022), merchantmaverick.com/how-does-stripe-work/ ; (3) Amazon Pay, *Innovative Merchant Payment Services for Small to Medium Businesses*, pay.amazon.com/business/small-business; Amazon Pay Sign up, pay.amazon.com/; (4) Braintree, *Pricing*, braintreepayments.com/braintree-pricing; Braintree, *Boost Revenue with a Global Payments Partner*, braintreepayments.com/ ; (5) Square, Payments, squareup.com/us/en/payments/pricing; Square, Payment Platforms, squareup.com/us/en/payments/payment-platform; Square, *Your all-in-one restaurant POS system*, squareup.com/us/en/point-of-sale/restaurants. (6) Shannon Vissers, *The Complete 2022 Clover Pricing Guide* MERCHANT MAVERICK (Aug. 19, 2021), merchantmaverick.com/clover-pos-cost/ (This rate is for point-of-sale

+ $0.30 for online purchases. †† Vanco offers 2.9% + $0.45 with their "Grow" plan (no monthly fee) and 2.65% + $0.39 for their "Thrive" plan ($49 monthly fee). ††† For the "Starter" plan, it costs $99 plus transactional fees running from $0.08 to $0.15; for the "Enterprise" plan, it costs $199 plus transactional fees running from $0.06 to $0.12. Fattmerchant claims this comes out to less than 1.5% for businesses that process more than $80K annually. *See* source below. †††† Adyen charges a fixed €0.10 processing fee plus a variable payment method fee based on the payment method used. *E.g.,* American Express cards in North America are charged 3.3% + $0.10; Mastercard cards are charged an Interchange fee. Interchange fees are 2% on average within the US. *See* www.adyen.com/blog/interchange-fees-explained.

D. Standard Economic Principles Show That Developers Would Pass Through to Consumers at Least a Portion of Any Savings from a Lower Take Rate

335. Google's take rate from developers typically ranges from 15 to 30 percent of revenue, with the average at approximately 30 percent.[786] In the competitive but-for world, these costs would have been lower. As explained in this section, standard economic models applied to data produced in discovery demonstrate all or almost all U.S. Consumers would have benefitted as a result. I take no position on whether proof of pass-through is necessary under the law.[787]

1. Standard Economics Shows That Prices Depend on Costs

336. One of the most universal principles of economics is that prices depend on costs.[788] Prices rise as marginal costs rise and fall as marginal costs fall. In perfectly competitive markets, firms pass through to buyers 100 percent of marginal cost increases or decreases in the form of correspondingly higher or lower prices.[789] In the absence of perfect competition, or indeed any

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transaction; Clover charges 3.5% + $0.10 for online (keyed in) transactions); Verizon Communications, *Verizon Business offers touchless payment capability with Clover from Fiserv*, GLOBENEWSWIRE (Dec. 10, 2020), globenewswire.com/news-release/2020/12/10/2143226/0/en/Verizon-Business-offers-touchless-payment-capability-with-Clover-from-Fiserv.html/ (7) authorize.net, *Pricing,* authorize.net/sign-up/pricing html; Featured Customers – Autorize net, featuredcustomers.com/vendor/authorizenet/customers. (8) Vanco, *Pricing,* www.vancopayments.com/egiving/pricing; Neal St. Anthony, *Vanco Payment Solutions grows as electronic bridge between churches, charities and their donors*, STAR TRIBUNE (Aug. 31, 2020), startribune.com/vanco-payment-solutions-grows-as-electronic-bridge-between-churches-charities-and-their-donors/572250712/. (9) POSQuote.com, *Fattmerchant vs. Square: Which Payment Processor Is Best?,* posquote.com/review/fattmerchant-vs-square; Stax Payments – Healthcare, staxpayments.com/healthcare/. (10) Adyen, *Pricing,* www.adyen.com/pricing; www.adyen.com/customers. (11) Bankrate, *Guide to Google Pay* (Jan. 14, 2021), www.bankrate.com/finance/credit-cards/android-pay-google-pay-guide/#:~:text=While%20there%20is%20no%20charge,you%20use%20a%20credit%20card.; Google Pay, *For Business,* pay.google.com/about/business/partners/. (12) Mark Jansen, Christian de Looper, and Paula Beaton, *PayPal vs. Google Pay vs. Venmo vs. Cash App vs. Apple Pay Cash*, DIGITAL TRENDS (July 5, 2021), digitaltrends.com/mobile/paypal-vs-google-wallet-vs-venmo-vs-square-cash/; MacRumors, *Apple Pay,* www macrumors.com/roundup/apple-pay/#:~:text=Some%20of%20Apple's%20partners%20include,Bell%2C%20and%207%2D11.

786. *See* Table 8, *supra*, Row 3; *see also* Table 6, *supra*, Row 6.

787. In the event that proof of pass-through is not necessary under the law, I have been asked to calculate damages based on the full reduction in the take rate in the but-for world. I do so in Part VII.A below.

788. *See, e.g.,* MANKIW, Chapter 4; Chapter 13.

789. *Id.* at 272, Figure 1 (showing price = marginal revenue = marginal cost for a competitive firm).

competition, elementary economic principles of profit-maximization still dictate that prices will rise and fall with marginal costs.[790] Even if a firm has market or monopoly power, it will still maximize profits by passing costs to buyers; the fraction passed through depends on the shape of the demand curve (e.g., flat or curved). For example, with a linear demand curve (a downward sloping straight line), even in monopolistic markets, at least half of marginal cost savings are passed through to customers.[791] For nonlinear demand curves, the pass-through rate generally exceeds 50 percent.[792] For a demand curve with a constant elasticity, pass-through exceeds 100 percent.[793]

337. In markets served by competing firms with some degree of market power, such as developers on the Play Store or in the In-App Aftermarket, prices fall as marginal costs decline whenever firms choose price to maximize profit. A firm selling a single product (and thus facing downward-sloping demand) maximizes profit by charging a markup of price over cost equal to the inverse of the elasticity of demand.[794] This inverse elasticity rule can be written:

$$(P - C) / P = 1 / E_{\mathrm{D}},$$

where P is the price of the product, C is its marginal cost, and E_{D} is the firm's own-price elasticity of demand, defined as the percentage decrease in quantity demanded generated by a one percent increase in price. As seen above, the greater is C, the higher P must be to balance the equation.[795]

790. *See, e.g.,* Hausman & Leonard at 708 ("profit maximization by the firm causes it to pass through at least some of the cost savings in terms of a lower price, even if the firm is a monopolist.").

791. *Id.* at 707 ("[S]o long as demand curves have the expected shape, the minimal amount of marginal cost savings passed on by a monopolist in terms of lower price is one-half of the cost savings.").

792. *Id.* at 721-724.

793. Theon van Dijk & Frank Verboven, *Quantification of Damages*, 3 ISSUES IN COMPETITION LAW AND POLICY 2331, 2342 (ABA Section of Antitrust Law 2008) ("When the price elasticity of demand is constant, η=0, and firms find it optimal to keep their percentage price-cost markup constant regardless of the cost conditions. This implies that a cost increase would lead to a higher absolute price cost-margin, which promotes pass-on.").

794. Hausman & Leonard at 713 (equation (5)). *See also* Landes & Posner at 937 (showing the analogous inverse-elasticity markup for a monopolist); Steven Berry, *Estimating Discrete Choice Models of Product Differentiation* 25(2) RAND JOURNAL OF ECONOMICS 242–262 (1994); Gregory Werden & Luke Froeb, *The Antitrust Logit Model For Predicting Unilateral Competitive Effects* 70 ANTITRUST LAW JOURNAL 257 (2002); Aviv Nevo, *Mergers with Differentiated Products: the Case of the Ready-to-Eat Cereal Industry*, 31(3) RAND JOURNAL OF ECONOMICS 395-421 (2000).

795. In my expert report in support of class certification, I derived an alternative form of this equation, written $(P - C^*) / P = 1 / E_{\mathrm{D}}$ to illustrate how an increase in the take rate is analogous to an increase in marginal cost. *See* Singer Class Certification Rpt. ¶¶ 224-25. I understand that in its class certification briefing Google argued that a component of this equation, $C^* = C/(1\text{-}t)$, meant that a change in take rate would affect developers' marginal costs only in proportion to their existing costs. This argument is without merit. I did not offer this equation as method to calculate pass-through, nor could it be used reliably for this purpose. Among other things, Google ignores that a developer's own-firm demand elasticity, E_{D}, depends on the supply responses of other developers. The equilibrium pass-through rate must take these responses into account. The logit pass-through rates that I calculate do exactly that, by solving for each developers' optimal price, given what other developers are charging. Consistent with standard economic practice, I then calculate the change in equilibrium prices resulting from a lower take rate by multiplying (1) the change in marginal costs resulting from a lower take rate; by (2) the logit pass-through rate. *See, e.g.,* Sharat Ganapati, Joseph Shapiro, & Reed Walker, *Energy Cost Pass-Through in US Manufacturing: Estimates and Implications for Carbon Taxes* 12(2) AMERICAN ECONOMIC JOURNAL: APPLIED ECONOMICS 303, 311-315 (2020) (illustrating how prices increase as a result of an upward shift in the marginal cost curve, with the shift equal to the change in average variable costs resulting from a change in the tax rate).

338. The competitive but-for world contemplates a long-run equilibrium, in which Google's take rate is substantially and permanently lower. Standard economics shows that a substantial and permanent reduction in developer's costs will cause substantial and permanent downward pricing pressure: Higher long-run costs mean higher prices, and vice-versa. In the long run, a profit-maximizing firm must either charge a price sufficient to cover its average *total* costs—inclusive of fixed costs—or exit the market.[796] To remain in business, a profit-maximizing firm must cover both its explicit costs of doing business and the opportunity costs incurred by not deploying its resources elsewhere.[797] Competition over the long run pushes prices downward towards levels that enable firms to cover their explicit costs and earn a competitive rate of return.[798] If Google's take rate were substantially and permanently lower, developers could cover all their costs and earn a competitive rate of return while charging consumers lower prices than they could otherwise.

2. U.S. Consumers Would Have Benefitted from Developers' Substantially Lower Costs through Various Economic Mechanisms

339. U.S. Consumers would have benefitted from developers' lower costs in several ways. *First*, standard economics shows that Google's take rate influences a developer's initial decision regarding pricing for paid Apps (and the pricing of any In-App Content) when the developer first enters the market (or when the developer first introduces new In-App Content). A developer faced with the prospect of paying up to 30 percent of its revenue to Google in perpetuity, all else equal, will need to charge a higher price to consumers than a developer facing a lower take rate. A developer's decision to enter and remain in the market depends on its ability to both cover its explicit costs and to earn a competitive rate of return. The greater the take rate, the higher the developer's price will need to be in order to do so.[799] For example, Adrian Ong of Match.com testified in *Epic v. Apple* that, if Match.com were "able to transact directly with the end users…it would allow us to price our products cheaper, like we do on the web."[800] In addition, the price that

796. *See, e.g.,* MANKIW, *supra*, at 273-277.
797. *Id*. at 250-251; 279-284.
798. *Id*.
799. *See, e.g.,* Margaret Harding McGill, *Exclusive: ProtonMail wades into U.S. antitrust war*, AXIOS (July 22, 2021), axios.com/2021/07/22/proton-swiss-privacy-app-us-antitrust ("At the top of Proton's list of grievances is the 30% commission Apple collects on subscriptions sold through its App Store, with Google planning to enforce the same fee (although Google recently announced a temporary extension to 2022). Proton's "freemium" model means it relies on paid subscriptions for revenue. The company raised prices for consumers to cover the Apple fee, and is facing the prospect of doing the same when Google enforces its fee. "As a small company, there is no way we can afford to just absorb those fees," Miseviciute said. "So we are forced to raise the subscription prices for our consumers."). *See also* Deposition of Adrian Ong, *Epic v. Apple* (February 24, 2021) at 76:9-77:5 [redacted]

800. Ong Dep. 33:24-34:7. *See also Id.* at 24:23-25:4 ("Q. Did Match do anything with the price of Tinder through the web in order to attempt to attract users? A. It is cheaper than what it is in the App stores. Q. Is Tinder through the web cheaper today than Tinder through the App stores? A. Yes."); *Id.* at 34:19-35:9 ("Q. Would there be benefits to Match Group from being able to transact directly with the end users of your products? A. Yes. Q. What would some of those benefits be? A. Again, ***we would not pay the margins of the 30 percent to Apple, which in turn***

the developer can charge to consumers will depend on the prices charged by competing developers: All else equal, a developer can charge a higher price when its competitors do the same—and competitors will charge higher prices when the take rate, and thus their costs, are higher.

340. *Second*, as explained above, standard economics shows that prices depend on costs; profit maximization dictates that decreased costs are passed through (at least partially) in the form of lower prices. In the competitive but-for world, developers' costs would have been substantially and permanently lower relative to the actual world. This, in turn, would have resulted in substantially and permanently lower prices paid by consumers. When South Korean developers were forced to comply with the Aftermarket Tie-In, prices for In-App Content reportedly increased by 15 to 20 percent.[801]

341. *Third*, developers would face clear economic incentives to engage in steering in a competitive but-for world with more than one distribution channel by sharing a portion of the cost savings from a lower take rate with consumers who download Apps or In-App Content from a lower-cost platform. Prices for paid Apps and In-App Content are set by the developer. If a developer is charged a lower commission by one supplier relative to another, the developer can incentivize consumers to use the lower-cost supplier if the developer adjusts downward prices to consumers through the lower-cost source. This adjustment will steer customers to the favored supplier. In response, Google would be incentivized to lower its commissions from developers to prevent steering away from Google Play Billing (as well as from the Play Store in the Android App Distribution Market).

342. One possible mechanism for steering is illustrated by the Ultimatum Game, described originally by economist and Nobel laureate John Harsanyi in 1961.[802] Consider a setting in which a developer stands to save $1 in "service fees" per transaction if its customer elects to transact on a lower-cost platform than the Play Store for Apps or transacts through a payment processor other than Google Play Billing for In-App Content. To induce the consumer to select the lower-cost alternative, the developer must decide how much of the dollar to share with the consumer in the form of a reduced price for Apps or In-App Content. If the developer is not sufficiently generous with the amount offered, the consumer will continue to transact with Google, depriving the developer of any savings.

343. Google's documents explicitly contemplate steering as a consequence of lower take rates.[803] The slide below illustrates Google's projection of steering incentives if payment processing were unbundled, summarized by the asterisks in the final column. (It bears emphasis

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would result in lower prices for customers. Roughly, it costs less than 5 percent, you know, to manage payments, refunds, all of that. If you look at PayPal, it's under 2 percent to use PayPal. And the App Store, in-App payments, PayPal is an option there, so I'm not sure why we're paying 30 percent when it costs us less than 2 percent to use exactly the same payment method.") (emphasis added). Mr. Ong is Senior Vice President of operations of Match Group. *Id. at* 9:24-25.

801. *See* Mansoor Hameed, *South Korean users file police complaint against Google CEO Sundar Pichai*, INDO-ASIAN NEWS SERVICE (June 3, 2022), siasat.com/south-korean-users-file-police-complaint-against-google-ceo-sundar-pichai-2341259/.

802. John Harsanyi, *On the Rationality Postulates underlying the Theory of Cooperative Games,* 5(2) JOURNAL OF CONFLICT RESOLUTION 179–196 (1961).

803. *See e.g.,* GOOG-PLAY-006829073.R at -085.R (showing "Dev incentive to *steer user choice*" at lower take rates for payment processing) (emphasis added).

that, in the competitive but-for world, payment processing would be unbundled in tandem with distribution services in the In-App Aftermarket as Google's restrictions were eliminated.)

[redacted]

344. The first number in the "Option" column above displays Google's "unbundled" take rate—that is, the take rate excluding payment processing services. The second number is the extra amount that the developers would pay to Google, if Google also provided payment processing and if consumers chose Google rather than an alternative provider under Google's hypothetical scenarios. To illustrate, the third row displays [redacted] in the "Option" column, meaning that Google's hypothetical take rate consists of a base rate of [redacted] for Google's payment processing. The figure shows that as Google's unbundled take rate (again, excluding payment processing) decreases from [redacted] the greater are developers' steering incentives—that is, developers' incentives to "steer user choice" by lowering the price to consumers that select a lower-cost (non-Google) payment option. When the unbundled take rate is lower, there exists a greater likelihood that a cheaper alternative bundle can be constructed, with a combined take rate (including payment processing) below 30 percent.[804] The "Consumer Spend w/Choice" column displays Google's estimate of how much revenue

804. If a developer does not use an alternative payment processor, Google's take rate remains at 30 percent. The developer can therefore lower its total take rate if the unbundled take rate (paid to Google) *plus* the cost of a third-party payment processor is below 30 percent. The lower the unbundled take rate, the easier it will be for a developer to construct such a bundle.

could potentially move to competitive billing systems under each option. For example, in the first row, there is [redacted] so the final column [redacted]

345. *Fourth*, even if one assumes that some developers would not lower their prices in the competitive but-for world, consumers still would benefit from quality improvements in Apps and In-App Content that developers would be able finance out of monies saved from lower take rates. Standard economics shows that competition drives firms to make competitive investments in product quality to keep pace with rivals.[805]

3. Statistical Analysis Using Standard Economic Models Confirms Widespread Pass-Through in a Competitive But-For World

346. In this section, I apply standard econometric models to data produced in discovery to estimate the extent to which developers would have passed lower costs (that is, lower take rates) to consumers in the form of lower prices in a competitive but-for world without Google's restrictions. My empirical analysis suggests very high pass-through rates among developers (on the order of 91 percent).

347. Using standard multiple-regression methods, I have econometrically estimated demand curves encompassing initial App downloads and purchases of In-App Content. In each regression,[806] demand for a given App (or form of In-App Content) is modeled as a function of the price of that App (or the price of the In-App Content). All of the regressions include fixed effects.[807] Each fixed effect is unique to a given App, to subproduct(s) within the App if (any),[808] the user's state of residence, and to a purchase type for each transaction. Google's data presents three purchase types (initial downloads, in-app, and subscription). Thus, the regressions control for App-specific characteristics, as well as for differences in the demand for initial downloads of a given App, versus the demand for in-App purchases within that same App. The regressions also include fixed effects by year, which control for shifts in demand over time.

348. I use the standard logit demand system ("logit") to estimate the pass-through rate for each developer. Economists have frequently used logit to analyze a variety of economic phenomena, including (but not limited to) potentially anticompetitive conduct in markets with

805. Kenneth Arrow, *Economic Welfare and the Allocation of Resources to Invention*, *in* THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS, EDITED BY UNIVERSITIES- NATIONAL BUREAU COMMITTEE FOR ECONOMIC RESEARCH AND THE COMMITTEE ON ECONOMIC GROWTH OF THE SOCIAL SCIENCE RESEARCH COUNCILS 467– 92 (Princeton University Press 1962).

806. Department of Justice & Federal Trade Commission, *Horizontal Merger Guidelines* (2010), §10.

807. *See, e.g.,* JEFFREY WOOLDRIDGE, INTRODUCTORY ECONOMETRICS: A MODERN APPROACH, (THOMPSON 4TH ED. 2009), Chapter 14.1 [hereafter WOOLDRIDGE].

808. For example, the Pandora App has multiple subproducts, including Pandora Plus and Pandora Premium.

differentiated products.[809] In a logit demand system, each product within the system has its own (nonlinear) demand curve, given by the following formula:[810]

$$\ln(S_j / S_0) = \delta_j + \alpha P_j$$

809. *See, e.g.* Gregory Werden & Luke Froeb, *The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy* 10(2) JOURNAL OF LAW, ECONOMICS, & ORGANIZATION 407, 419 (1994) (Former DOJ economist Gregory Werden demonstrates how to use the logit model to analyze the extent to which higher prices resulting from mergers among long-distance carriers would be offset by lower costs being passed on to long distance customers: "we consider the possibility that the cost advantages of large firms can be extended through merger. Table 8 presents the calculated price and welfare effects under that assumption, using the simple logit model."). As the authors explain, "the logit model has direct policy relevance, since the 1992 Horizontal Merger Guidelines use it as the base case for the analysis of mergers in differentiated products industries." *Id.* at 408. Dr. Werden received a Lifetime Service Award from the DOJ, recognizing "his outstanding contributions to the enforcement of the antitrust laws throughout four decades of service." *See* justice.gov/atr/division-operations/division-update-spring-2019/attorney-general-honors-economist-dr-gregory-j-werden. *See also* Luke Froeb et al., *Economics at the Antitrust Division: 2017–2018*, 53 REVIEW OF INDUSTRIAL ORGANIZATION 637, 639-642 (2018) (explaining that logit is one of the primary models included in the antitrust software package developed by DOJ economists Charles Taragin and Michael Sandfort). *See also* Nathan Miller, Marc Remer, Conor Ryan, & Gloria Sheu, *Pass-Through and the Prediction of Merger Price Effects*, 64(4) THE JOURNAL OF INDUSTRIAL ECONOMICS 683, 684-685 (2016) (explaining logit is "commonly employed in antitrust analyses of mergers involving differentiated products."). *Id.* at 705 ("multinomial logit demand [is] the basic workhorse model of the discrete choice literature.") *See also* Jonas Bjornerstedt & Frank Verboven, *Merger simulation with nested logit demand*, 14(3) STATA JOURNAL 511 (2014) (Detailing how to implement merger simulations using logit models in STATA, a leading econometric software package). *Id.* at 530 ("The set of merger simulation commands can be used to simulate the effects of horizontal mergers in a standard setting (differentiated products, multiproduct Bertrand price setting). One can also incorporate various extensions, including efficiencies in the form of cost savings…"). *Id.* at 527-528 (post-merger prices resulting from an auto merger are computed using a nested logit model after accounting for pass-through of marginal cost savings; the results show "that the 20% cost savings are sufficiently passed to consumers.") *See also* Frank Verboven, *International price discrimination in the European car market*, 27(2) RAND JOURNAL OF ECONOMICS 240 (1996) (using a nested logit model to analyze European auto pricing). *See also* Frank Verboven & Theon Vandijk, *Cartel Damages Claims And The Passing-On Defense*, JOURNAL OF INDUSTRIAL ECONOMICS 457, 468 (2009) (using logit to analyze the extent to which direct purchasers overcharged by the European Vitamins Cartel would pass on the overcharges to indirect purchasers. When introducing the logit model, the authors explain that "the logit model…has been popular in many areas of antitrust analysis."). *See also* Kenneth Train, *Logit, in* DISCRETE CHOICE METHODS WITH SIMULATION, 34 (Cambridge University Press 2009) (Professor Train of MIT devotes an entire chapter of his textbook to the logit model, explaining that logit is "by far…the most widely used discrete choice model[.]"). *See also* David Besanko, Sachin Gupta, & Dipak Jain, *Logit Demand Estimation Under Competitive Pricing Behavior: An Equilibrium Framework*, 44 MANAGEMENT SCIENCE 1533 (1998) ("The logit model of consumer choice has now become a standard tool for estimating the impact of marketing mix variables, such as price and sales promotions, on consumer brand choice."). Google's own class certification economist, Dr. Michelle M. Burtis, conceded that logit is "frequently used in economics[.]" Expert Report of Dr. Michelle M. Burtis dated March 31, 2022 ("Burtis Class Report") ¶306.

810. Academic economists sometimes use "random coefficient" logit models (or "mixed logit" models). In practice, these techniques suffer from well-known computational problems, which can severely limit their applicability and accuracy when applied to real-world data sets. *See, e.g.* Christopher Knittel & Konstantinos Metaxoglou, *Estimation Of Random-Coefficient Demand Models: Two Empiricists' Perspective* 96(1) REVIEW OF ECONOMICS AND STATISTICS 34 (2014) ("We document the numerical challenges we experienced estimating random-coefficient demand models as in Berry, Levinsohn, and Pakes (1995) using two well-known data sets and a thorough optimization design. The optimization algorithms often converge at points where the first-and second-order optimality conditions fail. There are also cases of convergence at local optima.").

Above, S_j is the share of product j, and S_0 is the share of the outside good—that is, the proportion of consumers that do not purchase any of the products at issue.[811] The term δ_j represents factors other than price that shift demand (and thus share). These are modeled as fixed effects unique to a given App and purchase type (Initial Downloads, In-App, and Subscription).[812] The model also includes fixed effects by state, and for sub-products within a given App (e.g., Pandora Plus versus Pandora Premium).[813]

349. My regressions are structured around 33 App categories used by Google, developers, and consumers.[814] More than 99 percent of the Apps are assigned to just one category in Google's Transaction Data.[815] Using the Play Store's categories makes economic sense because they reflect economically reasonable groupings of consumer tastes for different varieties of Apps, as recognized by a range of industry participants, including Google. According to Google, "Categories and tags help users to search for and discover the most relevant Apps in the Play Store."[816] Record evidence indicates that Google uses App categories to conduct consumer research by application type. For example, a July 2017 consumer survey was designed "[t]o provide an understanding of how *within each category* users discover Apps, the triggers and barriers that lead to a subscription."[817] A 2014 App Annie study commissioned by Google tracked download and revenue growth based on Google's categories.[818] An October 2015 Google study on differences in consumer spend between iOS and Android also used App categories to segment its

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811. Record evidence indicates that no more than [redacted] of users make purchases of In-App Content or initial downloads in a given month; this provides one possible estimate of the share of the outside good. GOOG-PLAY-000559379 at GOOG-PLAY-000559380 (a Play Store update for Alphabet Board (2020) stating [redacted] As explained below, because the pass-through rate in the logit model increases with the share of the outside good, I conservatively set it to zero for purposes of my pass-through calculations.

812. *See, e.g.,* WOOLDRIDGE, Chapter 14.1.

813. The fixed effects are interactive; for example, there is a different fixed effect for Pandora Plus purchased by a customer in California versus Pandora Plus purchased by a customer in Texas.

814. In 2016, Google modified and expanded the categories available through the Play Store. In the process, the "Transportation" category was renamed "Maps & Navigation," and the "Media & Video" category was renamed "Video Players & Editors." Therefore, I have classified Apps formerly under the "Transportation" category under the "Maps & Navigation" category, and I have classified Apps formerly under the "Media & Video" category under the "Video Players & Editors" category. *See* Android Authority, *Google Play to add new App categories to make finding them easier* (July 27, 2016), androidauthority.com/google-play-store-new-app-categories-706028/; Sarah Karam, *Introducing new App categories -- From Art to Autos to Dating -- to help users better find your Apps*, ANDROID DEVELOPERS BLOG (July 26, 2016), android-developers.googleblog.com/2016/07/introducing-new-app-categories-from-art.html.

815. Less than 0.2% of all App titles are classified into multiple App categories in Google's Transaction Data. An even smaller proportion—less than 0.1% of all App titles—are classified into multiple App categories at the same point in time. In these rare cases, I assigned the App to the category in which it was most frequently transacted. This ensures that, for purposes of my analysis, each App title is associated with a single category.

816. Play Console Help, *Choose a category and tags for your App or game,* support.google.com/googleplay/android-developer/answer/9859673?hl=en#zippy=%2CApps%2Cgames (listing each of the Play Store's categories, with a description of each).

817. GOOG-PLAY-000294117.R at GOOG-PLAY-000294118.R (emphasis added). The survey, of users in Japan, targeted users of Apps "in seven categories: Dating, Entertainment, Music, Health & Fitness, News, Education, Manga/Webtoon & Family."

818. GOOG-PLAY-000076773 at GOOG-PLAY-000076785 ("Although Games dominate revenue gains, growth is almost universal across categories."); GOOG-PLAY-000076766 (cover email noting that "we worked with App Annie on the attached report that was released this morning.").

analysis.[819] Google recognized in its 2016 Plan for "Google Play Developer Marketing" that "developers engage more with category-specific content" and planned for "category expertise, [to] drive actionable insights."[820]

350. The Play Store's categories are also used by industry analysts.[821] Developers, who presumably know their customers best, use Google's categories to sell their Apps in competition with other developers; they have clear incentives to select a meaningful category to maximize the value of their Apps.[822] If the developer of a "Parenting" App misclassified their App into the "Auto & Vehicles" category, that developer's ability to compete would likely be compromised. The evidence also shows that the Play Store's categories are economically meaningful to consumers, given their prominent display within the Play Store and given that consumers can filter the Apps displayed to them based on the Play Store categories.[823] Apple's App Store uses a similar set of categories, as seen below:

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819. GOOG-PLAY-000579868.R at GOOG-PLAY-000579870.R, GOOG-PLAY-000579878.R.

820. GOOG-PLAY-000303918.R at GOOG-PLAY-000303926.R, GOOG-PLAY-000303930.R.

821. *See, e.g.,* David Curry, *App Data Report,* Business of Apps (2022) at 10 (chart showing Google Play categories by volume); *see also* Sensor Tower, *2021 – 2025 Mobile Market Forecast,* (2021) at 39, go.sensortower.com/rs/351-RWH-315/images/Sensor-Tower-2021-2025-Market-Forecast.pdf (showing projected consumer spending for top categories, including Games, Social, Entertainment, Comics, Productivity, and Health & Fitness); Statista, *Most popular Google Play App categories as of 1st quarter 2021, by share of available Apps,* https://www.statista.com/statistics/279286/google-play-android-app-categories

822. Play Console Help, Choose a category and tags for your App or game, *supra* ("**Choose a category and tags for your App or game** You can choose a category and add tags to your App or game in Play Console. Categories and tags help users to search for and discover the most relevant Apps in the Play Store. Users can view Apps by using a browser and the Google Play app.") (emphasis in original).

823. *See* Google Play Store, *Apps,* https://play.google.com/store/Apps (click on drop-down menu).

TABLE 11: COMPARISON OF PLAY STORE AND APP STORE CATEGORIES

Play Store Category Name	App Store Category Name
Art and Design	Graphics and Design
Auto & Vehicles	N/A
Beauty	Lifestyle
Books & Reference	Books/Reference
Business	Business
Comics	Books
Communications	Social Networking
Dating	Social Networking
Education	Education
Entertainment	Entertainment
Events	Entertainment
Finance	Finance
Food and Drink	Food and Drink
Games	Games
Health and Fitness	Health and Fitness
House & Home	Lifestyle
Library & Demo	N/A
Lifestyle	Lifestyle
Maps & Navigation	Navigation
Medical	Medical
Music and Audio	Music
News and Magazines	Magazines & Newspapers/News
Parenting	Lifestyle
Personalization	Graphics & Design/Utilities
Photography	Photo and Video
Productivity	Productivity
Shopping	Shopping
Social	Social Networking
Sports	Sports
Tools	Utilities/Developer Tools
Travel & Local	Travel
Video Players & Editors	Photo and Video
Weather	Weather

351. Although the logit demand system incorporates market shares, it bears emphasis that these need not be shares of a relevant antitrust product market. As DOJ economist Gregory Werden has observed, the market used in a logit demand system "may be more or less inclusive than a relevant antitrust market."[824] The logit demand model also does not imply that all products in the market are perfectly interchangeable, but instead allows for product differentiation.[825] Products that are more attractive to most consumers (and thus have higher market shares) command more pricing power than less-attractive products with lower market shares.[826] As detailed below, what the logit demand system does imply is that developers in a given category pass through cost savings according to their dominance (or lack thereof) in the category, as measured by their market share within that category. For example, if Microsoft, which sells both Word and Excel, dominates the productivity category with its Microsoft 365 package (formerly known as Office, a bundle of Word, Excel, and PowerPoint), Microsoft is predicted to pass through a smaller portion of any cost reduction, all things equal. It is reasonable to assume that Microsoft 365 is a substitute for Google's bundle of productivity Apps called Google Workspace. Both Microsoft 365 and Google Workspace are included in Google's "Productivity" category.

352. Although there is no requirement that the market share for the logit demand model be computed in a relevant antitrust market, it bears noting that antitrust has recognized "cluster markets," in which the market is comprised of items that are not always substitutes. As antitrust scholar Herbert Hovenkamp has noted, cluster markets have aggregated products as diverse as office supplies.[827] In a cluster market, a hypothetical monopolist over (say) paperclips, staples, paper, and other office supplies can profitably raise prices above competitive levels, given that many customers are likely to purchase many or all of their office supplies from the same source. By the same logic, a hypothetical monopolist over games ranging from "Thomas and Friends" to "Poker – Texas Hold'em" could also likely wield monopoly power, given that many households likely "need or at least prefer the convenience of"[828] purchasing games for all members of the family from the same source.

353. In Table 12 below, I econometrically estimate logit demand systems using standard ordinary least squares ("OLS") regressions[829] using the Google Transaction Data. In addition, I used standard instrumental-variable ("IV") regressions to correct for endogeneity.[830] In the IV

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824. Gregory Werden & Luke Froeb, *The Antitrust Logit Model For Predicting Unilateral Competitive Effects* 70 ANTITRUST LAW JOURNAL 257 (2002). Economists make use of market shares in industries that may not perfectly correspond to an antitrust product market. *See, e.g*., José Azar, Ioana Marinescu & Marshall Steinbaum, *Labor Market Concentration*, 57(3) JOURNAL OF HUMAN RESOURCES (2020) (finding that variation in wages could be explained by measures of labor market concentration within an occupational code using vacancy shares from CareerBuilder.com).

825. Gregory Werden & Luke Froeb, *The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy* 10(2) JOURNAL OF LAW, ECONOMICS, & ORGANIZATION 407, 408 (1994) ("the logit model has direct policy relevance, since the 1992 Horizontal Merger Guidelines use it as the base case for the analysis of mergers in differentiated products industries.").

826. *Id.* at 410 (equation (3) shows that the own price elasticity for a given product (ε_j) decreases with the market share (π_j)).

827. Hovenkamp, *Digital Cluster Markets, supra* at 276 ("In the *Staples* merger case, the court defined a cluster market…The expert concluded 'that a *monopoly* provider of consumable office supplies would charge significantly more to large customers than Staples and Office Depot today charge these same customers.'").

828. *Id.* at 253.

829. WOOLDRIDGE, *supra*, Chapter 3.

830. Instrumental variables techniques are used to identify the demand curve separately from the supply curve. *Id.* Chapter 15.

regressions, taxes are used as an exogenous instrument that shifts price independently of other demand drivers.[831]

354. I estimate logit demand systems for each of the categories used by Google.[832] Consistent with economic expectations, the regression results confirm a negative and highly statistically significant relationship between demand and price. For example, in Table 12 below, the coefficient on price in the first row of Column (1) is –0.0270, and it is highly statistically significant, with a *p*-value of 0.000. Accordingly, a one dollar increase in price leads to a 2.70 percent decrease in share within the "Art & Design" category.[833] Column (2) shows how the regression output changes after I correct for price endogeneity using an instrument variables (IV) approach. According to the first row of Column (2), a one dollar increase in price leads to a 2.43 percent decrease in share within the "Art & Design" category. This result is also highly statistically significant. For all categories, both the OLS results and the IV results are consistent with economic expectations, in that the coefficient on price is both negative and statistically significant. As summarized by the *R*-squared statistics below, the logit demand systems explain approximately 95 percent of the variation in the category shares.

831. Taxes are used as instrumental variables because they directly affect price but are uncorrelated with other demand shifters. *Id.*

832. In these regressions, the share of the outside good is calculated on a category-specific basis. For example, the share of the outside good for the "Art & Design" category is equal to the share of the market that either (1) made purchases in any of the other categories; or (2) did not purchase at all.

833. This represents a percent change, as opposed to percentage points.

TABLE 12:
ECONOMETRIC ESTIMATES OF LOGIT DEMAND SYSTEMS BY PLAY STORE CATEGORY

App Category	(1) OLS Price Coefficient	(2) IV Price Coefficient
Art & Design	-0.0270***	-0.0243***
	(0.000)	(0.000)
Auto & Vehicles	-0.0289***	-0.0198***
	(0.000)	(0.000)
Beauty	-0.0397***	-0.0323***
	(0.000)	(0.000)
Books & Ref	-0.0436***	-0.0299***
	(0.000)	(0.000)
Business	-0.0217***	-0.0190***
	(0.000)	(0.000)
Comics	-0.0366***	-0.0277***
	(0.000)	(0.000)
Communication	-0.0189***	-0.0149***
	(0.000)	(0.000)
Dating	-0.0385***	-0.0275***
	(0.000)	(0.000)
Education	-0.0303***	-0.0260***
	(0.000)	(0.000)
Entertainment	-0.0429***	-0.0355***
	(0.000)	(0.000)
Events	-0.0392***	-0.0336***
	(0.000)	(0.000)
Finance	-0.0107***	-0.00911***
	(0.000)	(0.000)
Food & Drink	-0.0257***	-0.0223***
	(0.000)	(0.000)
Game	-0.121***	-0.0353***
	(0.000)	(0.000)
Health & Fitness	-0.0302***	-0.0266***
	(0.000)	(0.000)
House & Home	-0.0516***	-0.0362***
	(0.000)	(0.000)
Library & Demo	-0.0131***	-0.00840***
	(0.000)	(0.000)
Lifestyle	-0.0183***	-0.0152***
	(0.000)	(0.000)
Maps & Nav	-0.0195***	-0.0161***
	(0.000)	(0.000)

App Category	**(1) OLS Price Coefficient**	**(2) IV Price Coefficient**
Medical	-0.0284***	-0.0244***
	(0.000)	(0.000)
Music & Audio	-0.0367***	-0.0321***
	(0.000)	(0.000)
News & Mag	-0.0109***	-0.00916***
	(0.000)	(0.000)
Parenting	-0.0548***	-0.0492***
	(0.000)	(0.000)
Personalization	-0.0293***	-0.0254***
	(0.000)	(0.000)
Photography	-0.0533***	-0.0481***
	(0.000)	(0.000)
Productivity	-0.0346***	-0.0290***
	(0.000)	(0.000)
Shopping	-0.0658***	-0.0475***
	(0.000)	(0.000)
Social	-0.0616***	-0.0364***
	(0.000)	(0.000)
Sports	-0.0184***	-0.0135***
	(0.000)	(0.000)
Tools	-0.0406***	-0.0372***
	(0.000)	(0.000)
Travel & Local	-0.0490***	-0.0356***
	(0.000)	(0.000)
Video Players	-0.0408***	-0.0363***
	(0.000)	(0.000)
Weather	-0.0391***	-0.0287***
	(0.000)	(0.000)
Includes FE?	Y	Y
Number of FE	23,994,816	23,994,816
Observations	80,148,790	80,148,790
R-Squared	95.9%	95.7%

Notes: *p*-values in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Each column reports the logit price coefficient corresponding to a given Play store category. Coefficient estimates calculated using a single, fully-interacted regression model allowing coefficients to vary across the 33 Play Store categories. Fixed effects are unique to App name, App subproduct, purchase type (App sale, In-App purchase, subscription), customer state, App category, and year.

355. In Appendix 7, I perform a similar analysis within the "Games" category, subdividing the category into seventeen subcategories of Games used by Google and developers.[834] As before, the price coefficients are negative and highly statistically significant. The logit demand system explains approximately 90% of the variation in the Game subcategories.

356. The standard logit model is widely used by economists to estimate pass-through in a range of contexts. One common application arises in analyzing a proposed merger: Firms seeking approval for a merger often claim that any upward pricing pressure resulting from the merger will be offset by merger-driven cost savings that will be passed on to consumers. Economists use the logit model to analyze the extent to which cost savings would actually be passed through to consumers by the merging firms.[835] Economists also use logit to analyze pass-through outside the merger context, including (but not limited to): (1) analyzing pass-through of higher prices resulting from a cartel,[836] (2) analyzing how wholesale prices are passed on to retail prices;[837] and (3) analyzing the economic effects of price discrimination.[838]

357. The procedure used to calculate the logit pass-through rate depends on the conduct at issue. In a 2009 study, economists Frank Verboven and Theon van Dijk derived pass-through rates for cost increases faced by individual firms in their study of the European Vitamins Cartel, instead of applying a common cost increase to all purchasers from the cartel.[839] As the authors explain, "In a variety of settings it is not appropriate to assume that the cartel leads to a cost increase common to all firms in the plaintiff's industry…"[840] In particular, some members of the vitamins cartel were vertically integrated with downstream producers and may not have been

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834. Unlike the other categories, Google and developers use sub-categories within the Game category. See https://support.google.com/googleplay/android-developer/answer/9859673?hl=en#zippy=%2Cgames

835. *See, e.g.,* Gregory Werden & Luke Froeb, *The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy* 10(2) JOURNAL OF LAW, ECONOMICS, & ORGANIZATION 407, 419 (1994) ("[W]e consider the possibility that the cost advantages of large firms can be extended through merger. Table 8 presents the calculated price and welfare effects under that assumption, using the simple logit model."). *See also* Johan Stennek & Frank Verboven, *Merger Control and Enterprise Competitiveness: Empirical Analysis and Policy Recommendations*, in FABIENNE IIZKOVITZ & RODERICK MEIKLEJOHN, EUROPEAN MERGER CONTROL: DO WE NEED AN EFFICIENCY DEFENCE? 256 (Edward Elgar Publishing 2006) (using "the popular logit model…to illustrate how to measure pass-on.") *See also* Nathan Miller, Marc Remer, Conor Ryan, & Gloria Sheu, *Pass-Through and the Prediction of Merger Price Effects*, 64(4) THE JOURNAL OF INDUSTRIAL ECONOMICS 683-709, 693 (2016) (Table 1 shows pass-through estimates for logit. The median industry-wide pass-through estimate is 0.95 for logit, meaning that 95 percent of a change in marginal cost is passed on to consumers).

836. Frank Verboven & Theon Vandijk, *Cartel Damages Claims And The Passing-On Defense*, THE JOURNAL OF INDUSTRIAL ECONOMICS 457 (2009) (using logit to analyze the extent to which direct purchasers overcharged by the European Vitamins Cartel would pass on the overcharges to indirect purchasers).

837. K. Sudhir, *Structural Analysis of Manufacturer Pricing in the Presence of a Strategic Retailer* 20(3) MARKETING SCIENCE 244-264 (2001) (using logit to analyze pass-through of wholesale supermarket prices into retail prices paid by consumers). *See also* David Besanko, Jean-Pierre Dubé & Sachin Gupta, *Own-Brand and Cross-Brand Retail Pass-Through*, MARKETING SCIENCE 123, 127 (2005) (Table 1 summarizes logit pass-through rates derived in Sudhir (2001), *supra,* and for Besanko, Gupta & Jain (1998), *supra*).

838. Simon Cowan, *Third-Degree Price Discrimination and Consumer Surplus* 60(2) JOURNAL OF INDUSTRIAL ECONOMICS 333-345 (2012).

839. Verboven & Vandijk (2009) at 488 (calculating pass-through rates as the effect of "a cost increase by firm *i* on prices", and "effect of a cost increase of firm *i* on the industry price index").

840. Verboven & Vandijk (2009) at 469-470.

willing to overcharge companies that they owned.[841] Verboven and van Dijk demonstrated mathematically that the logit pass-through rates for individual firms turn entirely on market shares.[842]

358. More recently, the economists Nathan Miller, Marc Remer, and Gloria Sheu ("Miller et. al.") derived a general model of industrywide cost pass-through.[843] Within that general framework, Miller et. al. also derived pass-through formulae specific to logit.[844] These formulae show how profit-maximizing firms facing logit demand curves optimally respond to an industrywide change in costs. Given that the Challenged Conduct increased take rates for all developers, this is the most appropriate pass-through formula for this case. Miller et. al. demonstrate mathematically that, when firms are subjected to an industrywide change in costs, the profit-maximizing change in the price of a particular product *i* in response to a one dollar change in a firm's marginal cost is equal to $[M - Q_i]/M$, where M is the size of the category—inclusive of the outside good—and Q_i is the quantity sold of product *i*.[845] This means that, when demand is logit, a developer's pass-through rate can be estimated as one minus that developer's category share, consistent with what has been shown previously in the peer-reviewed economics literature.[846]

359. To see why the logit pass through rate can be estimated as one minus the developer's category share, note first that equation (1) in Miller et. al. determines firm *i*'s profit maximizing price, written as $f_i(P)$. Equation (2) in Miller et. al. analyzes how $f_i(P)$ changes in response to an industrywide change in cost.[847] Miller et. al. define the pass-through rate as $\partial P/\partial t$.

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841. Verboven & Vandijk (2009) at 482 ("Two premixers are vertically integrated with vitamin producers and may therefore not have been affected.")

842. Verboven & Vandijk (2009) at 488.

843. Nathan Miller, Marc Remer, & Gloria Sheu, *Using cost pass-through to calibrate demand*, 118 ECONOMICS LETTERS 451, 452 (2013).

844. *Id.* at 452-453.

845. *Id.*

846. Professor Cowan of Oxford derived a similar (albeit more limited) result in a paper published in 2012, which analyzed the pass-through rate for a monopolist facing a logit demand curve (whereas Miller et. al. derived more general formulae applicable to industries with heterogeneous competing firms). *See* Simon Cowan, *Third-Degree Price Discrimination and Consumer Surplus* 40(2) JOURNAL OF INDUSTRIAL ECONOMICS 333, 335 (2012) ("For the logit demand function pass-through is 1 - q*"). Under Prof. Cowan's notation, q* is the monopolist's market share. *Id.* at 344 (Appendix One: Logit Demand). Professor Sudhir of Yale also derived a similar (albeit more limited) result in an article published in 2001. Prof. Sudhir restricted his analysis to a single retailer (whereas Miller et. al. derived more general, industrywide formulae). *See,* K. Sudhir, *Structural Analysis of Manufacturer Pricing in the Presence of a Strategic Retailer* 20(3) MARKETING SCIENCE 244-264 (2001) (using logit to analyze pass-through of wholesale supermarket prices into retail prices paid by consumers). *Id.* at 251, equation (12) (with logit demand, a profit-maximizing retailer will, in response to a change in the wholesale price for a given product, adjust the retail price of that product by an amount proportional to $(1 - S_1)$, where S_1 is the share of the product in question.

847. Economists recognize that, in the case of ad valorem costs (that is, costs that are expressed as a percentage of revenue, such as a percentage tax), the industrywide change in costs is calculated based on the change in average variable costs resulting from a change in the tax rate (or, in this case, the take rate). That is the approach I adopt here. *See, e.g.,* Sharat Ganapati, Joseph S. Shapiro, & Reed Walker, *Energy Cost Pass-Through in US Manufacturing: Estimates and Implications for Carbon Taxes* 12(2) AMERICAN ECONOMIC JOURNAL: APPLIED ECONOMICS 303, 311-315 (2020).

Equation (2) shows that $\partial P/\partial t$ is equal to $\partial f(P)/\partial P$, multiplied by negative one and inverted.[848] Equation (6) of Miller et. al. shows that, for logit demand: $\partial f_i(P)/\partial P_i = -M/[M - Q_i]$, where M is the category size and Q_i is the quantity of product i. Based on equation (2), the logit pass-through rate is obtained by multiplying the right-hand side of equation (6) by negative one and inverting it, which yields $[M - Q_j]/M$.[849] This gives the amount by which firm i will increase its price in response to each one dollar increase in cost. For example, suppose that developer i accounts for 30 percent of the category. This means that $Q_i/M = 0.30$. Firm i's pass-through rate is $[M - Q_i]/M = M/M - Q_i/M = 1 - Q_i/M = 1 - 0.3 = 0.7$. Thus, in this example, for each one-dollar increase (decrease) in its own costs, the firm will optimally raise (lower) its price by \$0.70.[850]

360. In Table 13 below, I apply the pass-through formulae from Miller et. al. to calculate pass-through rates for each Play Store category. Each row of Table 13 displays the ratio of the dollar change in a developer's profit-maximizing price resulting from a one-dollar change in marginal cost. As seen below, the logit demand system yields an overall pass-through rate of 91.1 percent. This estimate is calculated as the weighted average across all categories, with each category receiving a weight proportional to the quantity of transactions in that category. (Thus, the "Game" category receives more weight than others). Similarly, the pass-through rates for each category are calculated as the weighted average pass-through rate for all Apps in the category. Thus, larger Apps receive more weight than smaller Apps.[851]

848. Both $\partial f(P)/\partial P$ and $\partial P/\partial t$ are matrixes of equal size. The number of rows in each matrix is equal to the number of firms in the market. The number of columns in each matrix is equal to the number of products in the market. For example, if there are two firms, each selling one product, both $\partial f(P)/\partial P$ and $\partial P/\partial t$ will be 2 x 2 matrixes.

849. This calculation conservatively ignores cross-price effects by setting the off-diagonal elements of the matrix $\partial P/\partial t$ to zero. If cross-price effects are considered, the logit pass-through rate exceeds the (1 – *Share*) formula described herein.

850. All else equal, the larger is the share of the outside good (S_0), the larger is M, and the larger is the pass-through rate. Because the pass-through rate increases with the share of the outside good, I conservatively set S_0 equal to zero for purposes of calculating pass-through using the logit demand system. In addition, I aggregate purchase quantities by developer.

851. In the Play Store, the "Tinder" App is categorized under the "Lifestyle" category, just as it is in the Apple App Store. *See* Google Play, https://play.google.com/store/Apps/details?id=com.tinder&hl=en_US&gl=US; Apple App Store Preview https://Apps.apple.com/us/app/tinder-dating-new-people/id547702041. In the alternative, I have been asked to recalculate Tinder's pass-through rate after recategorizing it into the "Dating" category. When I do so, Tinder's estimated pass-through rate changes from [redacted] to [redacted]

TABLE 13: PASS-THROUGH RATES BY CATEGORY

App Category	Pass-Through Rate
ALL	**91.1%**
ART_AND_DESIGN	66.9%
AUTO_AND_VEHICLES	81.9%
BEAUTY	43.9%
BOOKS_AND_REFERENCE	84.7%
BUSINESS	84.6%
COMICS	59.5%
COMMUNICATION	87.9%
DATING	81.4%
EDUCATION	91.9%
ENTERTAINMENT	84.9%
EVENTS	47.4%
FINANCE	74.1%
FOOD_AND_DRINK	80.6%
GAME	93.8%
HEALTH_AND_FITNESS	94.4%
HOUSE_AND_HOME	70.5%
LIBRARIES_AND_DEMO	58.9%
LIFESTYLE	65.5%
MAPS_AND_NAVIGATION	83.9%
MEDICAL	92.8%
MUSIC_AND_AUDIO	41.4%
NEWS_AND_MAGAZINES	87.7%
PARENTING	84.6%
PERSONALIZATION	87.3%
PHOTOGRAPHY	92.0%
PRODUCTIVITY	83.8%
SHOPPING	41.3%
SOCIAL	88.6%
SPORTS	79.9%
TOOLS	96.3%
TRAVEL_AND_LOCAL	88.2%
VIDEO_PLAYERS	86.1%
WEATHER	80.0%

361. In summary, I estimate that developers' profit-maximizing response to a one dollar decrease in costs would be to decrease their prices to consumers by approximately $0.91. This price decrease is profit-maximizing because the marginal benefit to developers of lowering the

price in the competitive but-for world—increasing the demand for Apps or In-App Content—exceeds the marginal cost of meeting the increased demand. If developers were to reduce their prices by less, their profit in the competitive world would be lower.

362. In Appendix 7, I perform a similar analysis within the "Games" category, estimating a different pass-through rate for each of the Game subcategories used in the Play Store. The weighted average pass-through rate across all of the Game subcategories is 79.1 percent. The pass-through rates for the Game subcategories range from 52.3 percent (Educational) to 95.5 percent (Role Playing)]].

363. Consistent with standard economic methods, I use the pass-through rates for the 33 categories to estimate but-for prices by multiplying (1) the change in marginal costs resulting from a lower take rate; by (2) the pass-through rate. To illustrate, suppose a developer charges a price of $10 in the actual world, and that the take rate is 30 percent. If the developer's take rate falls to 15 percent in the but-for world, its marginal cost savings can be conservatively estimated as $10*(0.30 – 0.15) = $1.50.[852] Assume that the developer's pass-through rate is 90 percent. The amount of the cost savings passed on to consumers can be calculated as [$1.50 x 0.90] = $1.35. The but-for price can then be conservatively calculated as $10 - $1.35 = $8.65. Using a more precise calculation, the but-for price can be calculated as $8.43.[853]

4. Analysis of Pass-Through in Alternative Settings Corroborates Developer Pass-Through

364. In this section, I provide evidence and examples of pass-through that support my econometric calculation of the pass-through rate.

V. *Apps That Avoid In-App Aftermarket Restrictions*

365. Historically, some developers using the Play Store, including Netflix, Spotify, and Tinder, have refused to compel their customers to use Google Play Billing for In-App Content by instead redirecting them to a web browser.[854] Some developers allow consumers to transact both within the Google Play Store and Google Play Billing as well as outside of them at a lower price, permitting an apples-to-apples comparison that provides evidence of pass-through. Bookedin, an appointment scheduling software App, points out that it "need[ed] to charge extra to compensate

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852. This estimate of marginal cost savings is conservative because the developer's marginal cost savings will be even greater as a result of pass-through. For example, suppose the developer's price falls from $10 to $9 when the take rate falls from 30 percent to 15 percent. The developer's marginal cost savings under this scenario are [$10 x 0.30] - [$9 x 0.15] = $1.65, which exceeds the $1.50 in marginal cost savings calculated above.

853. Continuing the example from the prior footnote, given a 90 percent pass-through rate, the but-for price (P_{bf}) satisfies the equation [$10 - P_{bf}]/ [$10 x 0.3 - P_{bf} x 0.15] = 0.90. Solving this equation for the but-for price yields P_{bf} = $8.43.

854. Ron Amadeo, *Google announces crackdown on in-App billing, aimed at Netflix and Spotify*, ARS TECHNICA (Sept. 20, 2020) ("Today, Netflix and Spotify don't use Google's in-App billing and instead kick new accounts out to a Web browser, where the companies can use PayPal or direct credit card processing to dodge Google's 30-percent fees"); *see also* Kif Leswing, *Google to enforce 30% take from in-App purchases next year*, CNBC (Sept. 28, 2020), www.cnbc.com/2020/09/28/google-to-enforce-30percent-cut-on-in-app-purchases-next-year html; Nick Statt, *Tinder is now bypassing the Play Store on Android to avoid Google's 30 percent cut*, THE VERGE (Jul. 19, 2019), www.theverge.com/2019/7/19/20701256/tinder-google-play-store-android-bypass-30-percent-cut-avoid-self-install.

for additional fees Apple and Google charge Bookedin to sell our App in their store."[855] The price offered on the Bookedin website for its "Pro 1" membership is $24/month vs. $34.99/month for the App sold through the Play Store, offering a 31 percent discount for avoiding Google's 30 percent take rate.[856] Down Dog, a yoga and exercise App, charges $7.99 a month on its website vs. $9.99 for the App purchased through the Google Play Store, implying a discount of 20 percent.[857] Tinder, a popular dating App and the second-highest grossing App on the Google Play Store, has discounted the subscription prices on its website by ten percent, relative to the price of the same subscriptions when purchased within the Play Store.[858] As observed by Jared Sine, Chief Legal Officer of Match Group (the parent company of Tinder), Google's and Apple's commissions amounted to "500 million dollars that could be going back into the pockets of everyday consumers or deployed to hire employees or invest in new innovations."[859]

366. Spotify, a popular music-streaming App, reluctantly allowed consumers to purchase its subscription music service from within Apple's App Store (where it did not negotiate a lower take rate). Spotify was forced to raise the cost of its premium subscription service within the Apple App Store from $9.99 per month to $12.99 per month in 2014.[860] This $3 increase can be understood as Spotify's attempt to roughly equalize its margins between its service through the internet ($9.99) and through the Apple App Store ($12.99).[861] Per Horacio Gutiérrez, Head of Global Affairs and Chief Legal Officer for Spotify: "Spotify could not absorb the IAP [in-App product] tax without raising its prices, because a large component of its costs are the licensing fees paid to record labels and music publishers."[862] Gutiérrez pointed out that "[o]ne doesn't need a Ph.D. in economics to recognize that Apple is hurting consumers by forcing competitors either to charge higher prices or preventing competitors from communicating offers of discounts or other promotional offers."[863] A European Commission investigation into prices charged by music-streaming providers showed that Apple's 30 percent commission rate was typically passed through

855. Bookedin, *Why are the prices different in App Store/Google Play?* (accessed June 15, 2021), support.bookedin.com/hc/en-us/articles/360028446492-Why-are-the-prices-different-in-App-Store-Google-Play-

856. ($34.99 - $24.00) / ($34.99) ≈ 31 percent.

857. ($9.99 - $7.99) / ($9.99) = ≈ 20 percent.

858. Based on prices observed on the Tinder website versus the prices through the Play Store on an Android device. Tinder Plus costs $9.99/month on the Play Store compared to $8.99/month on Tinder's website, implying a discount of ($9.99 - $8.99) / ($9.99) ≈ 10%. Tinder Gold costs $14.99/month on the Play Store compared to $13.49/month on Tinder's website, implying a discount of ($14.99 - $13.49) / ($14.99) ≈ 10%. Tinder Platinum costs $19.99/month on the Play Store compared to $17.99/month on Tinder's website, implying a discount of ($19.99 - $17.99) / ($19.99) ≈ 10%.

859. Testimony for the S. Judiciary Committee, Subcomm. on Competition Policy, Antitrust, and Consumer Rights, at 2 (Jared Sine, Chief Legal Officer, Match Group, Apr. 21, 2021) [hereafter Sine Testimony].

860. Testimony for the S. Judiciary Committee, Subcomm. on Competition Policy, Antitrust, and Consumer Rights, at 8 (Horacio Gutierrez, Head of Global Affairs and Chief Legal Officer, Spotify, Apr. 21, 2021) [hereafter Gutierrez Testimony].

861. Celena Chong, *Spotify shows its iPhone users how to save $3 by avoiding Apple's App Store*, BUSINESS INSIDER (July 8, 2015), www.businessinsider.com/spotify-shows-users-how-to-save-3-by-avoiding-apple-app-store-2015-7 ("Both Spotify and Apple Music technically charge $9.99 a month, but subscriptions purchased through the iTunes App Store charges a 30 percent fee — causing Spotify to charge $12.99 for its premium service within iTunes to generate the same revenue."). Apple's 30 percent commission would be $3.90 on a price of $12.99. By raising its price by only $3, Spotify was passing through 77 percent ($3/$3.90) of the increase due to the imposition of Apple's take rate.

862. Gutierrez Testimony at n. 13.

863. *Id.* at 9.

in full to consumers.[864] Unlike with Apple, Spotify has been able to circumvent Google's take rate entirely.[865] YouTube's subscription service charges a higher price on the Apple App Store "due to Apple's 30% transaction fee[.]"[866] Table 14 summarizes the implied pass-through rates for major these major App developers.

864. Statement by Executive Vice-President Margrethe Vestager on the Statement of Objections sent to Apple on App Store rules for music streaming providers (Apr. 30, 2021) ("Our investigation showed that this fee was passed on to end users by raising prices, typically from 9.99 to 12.99 Euros.").

865. *See* Responses and Objections of Non-Party Spotify USA Inc. to Rule 45 Subpoena at 15, *In re Google Play Consumer Antitrust Litigation* (No. 3:20-cv-05761-JD) [redacted] Only recently have Google and Spotify entered into a "Choice in Billing" agreement where Spotify would pay Google [redacted].

866. Feng Dep. 292:4-293:9 (referencing GOOG-PLAY-00028505, a March 2018 email from Google's Samer Sayigh stating "YouTube uses Apple Billing on iOS. YT charges $12.99/month on iOS (vs. $9.99 on Android + web), due to Apple's 30% transaction fee[.])").

TABLE 14: PRICE COMPARISON OF APPS THROUGH WEBSITE VS. APP STORE

	App	Product	Website Price	App Store Price	Implied Pass-Through Rate*
1	Tinder	Gold Membership	$13.49/month	$14.99/month (Google Play)	33%
2	BookedIn	Professional	$24/month	$34.99/month (Google Play)	105%
3	Down Dog	Unlimited Access to All Down Dog Apps	$7.99/month	$9.99/month (Google Play)	67%
4	Spotify	Premium Subscription Service	$9.99/month	$12.99/month (Apple App Store)	77%
5	Tidal	Premium Subscription Service	$9.99/month	$12.99/month (Apple App Store)	77%
6	YouTube	Subscription Service	$9.99/month	$12.99/month (Apple App Store)	77%

*Pass-through rate = (App price – website price) / ($ App commission - $ website commission) using an assumed zero percent commission charged on the website. Assuming a zero percent commission on the website is conservative so this estimate reflects a lower bound. The calculations conservatively assume a 30 percent take rate paid by the developer to Google (or Apple). To the extent that a developer pays a lower take rate, that developer's pass-through rate would be understated.

Sources: (1 – Tinder) Publicly advertised price; (2 – BookedIn) Appointment Booking & Online Scheduling Software – Pricing – BookedIn, support.bookedin.com/hc/en-us/articles/360028446492-Why-are-the-prices-different-in-App-Store-Google-Play (3 – Down Dog) Publicly advertised price; (4 – Spotify) Gutierrez Testimony at 8; (5-Tidal) Shahar Ziv, *Here's Why Your Apple App Store Purchases May Be A Ripoff*, FORBES (July 8, 2020), forbes.com/sites/shaharziv/2020/07/08/heres-why-your-apple-app-store-purchases-may-be-a-ripoff/?sh=77c6e9872007 ; (6-YouTube) Feng Dep. Tr. 292:4-293:9, *supra*.

b. Pass-Through of Sales Taxes and Digital Service Taxes

367. Google's take rate is economically analogous to a tax on developers. Elementary economics shows that changes in tax rates shift prices, including the prices paid by consumers for goods or services subject to sales taxes.[867] The imposition of state and local sales taxes on digital goods therefore provides a useful example for understanding pass-through in this case. Apps often serve customers across a number of different local tax jurisdictions. When a digital product is

867. *See, e.g.*, MANKIW, *supra*, at 120-127 (explaining the economics of how consumers share in the tax burden). *Id.* at 124-125 (providing an example explaining how payroll taxes, which are levied as a percentage of earnings, are passed on to workers in the form of lower wages). *See also* Sharat Ganapati, Joseph S. Shapiro, & Reed Walker, *Energy Cost Pass-Through in US Manufacturing: Estimates and Implications for Carbon Taxes* 12(2) AMERICAN ECONOMIC JOURNAL: APPLIED ECONOMICS 303, 311-315 (2020)

subject to a tax, this burden is typically passed through in full to the customer; it is not absorbed by the seller. Indeed, software APIs have been created to facilitate passing through the correct amount of tax based on the local jurisdiction and the product being sold.[868] Economically speaking, this arrangement is tantamount to a commission being imposed on a developer that is fully passed through to the consumer. As summarized by Spotify on its website:

> Some state and local governments may also require us to collect tax (e.g. Sales Tax) if Spotify undergoes marketing/promotional activities in the state or locality, or uses local sales agents or consultants. This fee is included at the point of the transaction, which is why you might see a slightly different price on your receipt to the rate that's advertised.[869]

Examples like this abound: Netflix,[870] Hulu,[871] Amazon,[872] and Google[873] all offer similar disclaimers on their websites regarding local sales taxes. As one press report summarizes, "If you live in one of the nearly 25 states that charge sales tax on digital goods or services you likely pay more for everything from downloaded music, e-books and ringtones to streaming TV shows and video."[874]

368. Economists recognize that taxes, including ad valorem taxes, are passed on to consumers in the form of higher prices.[875] Using Google's transaction data, I have performed standard regression analysis confirming that higher tax rates are systematically passed on to consumers in the form of higher prices for Apps and In-App Content. The dependent variable in

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868. *See, e.g.*, Jennifer Dunn, *Sales Tax by State: Should You Charge Sales Tax on Digital Products?* (Feb. 13, 2018), www.taxjar.com/blog/sales-tax-digital-products ("The TaxJar API allows you to assign a product tax code to the products you sell. If you assign the product tax code for digital goods to the digital products you sell, the TaxJar API automatically charges your customer in any state the right amount of sales tax depending on that state's applicable laws.").

869. Spotify, *Does the price for Premium include tax?,* support.spotify.com/us/article/sales-tax/.

870. Netflix, *Taxes on your Netflix membership,* help.netflix.com/en/node/50068#:~:text=The%20Netflix%20advertised%20price%20does,membership%20includes%20streaming%20and%20games ("The Netflix advertised price does not include sales tax. If sales tax applies, it is stated separately on your monthly invoice").

871. Hulu, *Why was I charged tax?,* help.hulu.com/s/article/charged-sales-tax#:~:text=Why%20was%20I%20charged%20tax%3F&text=In%20certain%20jurisdictions%2C%20Hulu%20is,that%20is%20assessing%20the%20tax ("In certain jurisdictions, Hulu is required to charge tax on our services in order to comply with your state and local laws. This is based on your billing address. When applicable, these taxes are collected by Hulu and are then remitted to the jurisdiction that is assessing the tax.").

872. Amazon, *Help & Customer Service – Tax on Amazon Prime*, www.amazon.com/gp/help/customer/display html?nodeId=202036230 ("If you choose to continue, you'll automatically be charged for Amazon Prime plus any applicable taxes").

873. Google, *Tax rates and value-added tax (VAT) – Play Console Help,* support.google.com/googleplay/android-developer/answer/138000?hl=en ("In accordance with sales tax requirements, Google is responsible for determining, charging, and remitting sales tax for Google Play Store App and in-App purchases by customers in these states. Google will collect and remit sales tax to the appropriate tax authority, as applicable. You don't need to calculate and send sales tax separately for customers in these states. Even if you're not located in the United States, this treatment will still apply.").

874. Melanie Hicken, *Are you paying the iTunes tax?*, CNN MONEY (June 5, 2013), money.cnn.com/2013/06/05/pf/taxes/itunes-tax/.

875. *See, e.g.,* N. GREGORY MANKIW, PRINCIPLES OF MICROECONOMICS 124-125 (Cengage Learning 8th ed. 2018) (explaining that payroll taxes, which are levied as a percentage of earnings, are passed on to workers in the form of lower wages). *See also* Simon Anderson, André de Palma, & Brent Kreider, *Tax Incidence in Differentiated Product Oligopoly* 81(2) JOURNAL OF PUBLIC ECONOMICS (2001) 173-192.

this regression is the natural logarithm of the price paid by the consumer, and the key independent variable is the tax rate. For example, the regression in column (1) shows that a one percentage-point increase in the tax rate increases the consumer price by approximately 1.1 percent, and the relationship is highly statistically significant.[876] Thus, an increase in the ad valorem tax rate implies an increase in the price paid by the customer. This provides particularly relevant direct evidence of pass-through because the Play Store's take rate is economically analogous to a tax.

TABLE 15: HIGHER TAX RATES PREDICT HIGHER PRICES

	(1)	**(2)**
Dependent Variable:	*ln(P)*	*ln(P)*
Tax Rate	0.0109***	0.00705***
	(0)	(0)
Constant	1.845***	1.871***
	(0)	(0)
Includes FE?	Y	Y
Number of FE	14,401,068	25,217,155
Observations	82,531,747	82,531,747
R-Squared	98.7%	99.3%

p-values in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Tax rates expressed as percentages. Fixed effects in column (2) are unique to App name, App subproduct, purchase type (App sale, In-App purchase, subscription), customer state, App category, and year. Fixed effects in column (1) are the same, except that they are not year-specific.

5. Google's Limited Take Rate Reductions In The Actual World Do Not Provide A Reliable Estimate of Marketwide Pass-Through In A More Competitive But-For World

369. In a more competitive but-for world, all or almost all developers would enjoy substantially and permanently lower take rates. In a competitive world with more than one App store or payment processor, developers would be incentivized to pass on savings from a lower take rate via steering and discounting, to induce consumers to switch to the low-cost provider. In a competitive but-for world, this would be facilitated by (1) multi-homing and steering among competing App stores in the Android App Distribution Market; and (2) consumer (or developer) choice of payment processors with steering in the In-App Aftermarket.[877] These incentives are absent in the actual world. Developers that enjoyed Google's limited take-rate decreases in the

876. For example, suppose that the price of an App is initially $2.00. The regression predicts that, if the tax rate increases by one percentage point, the price that the consumer pays for the App will increase by approximately 1.1 percent, from $2.00 to $2.02.

877. Singer Class Cert Report ¶¶169-175; ¶¶229-232. Record evidence indicates that price parity provisions further restricted steering. *See, e.g.* GOOG-PLAY-011072319 at -319—320 (email exchange explaining that (1) ADAP "reduces GPB revenue share from 30% to 15% for subscription offerings [redacted] and (2) that [redacted] had one of the [redacted] ADAP agreements at the time of this July 2020 email) (emphasis added).

actual world did not have to share any of the savings with their customers in order to realize the cost savings.

370. "Price "stickiness," which arises due to well-understood behavioral economic phenomena such as consumer anchoring,[878] would tend to limit pass-through in the actual world, while facilitating lower prices in the but-for world.[879] When a new App (or a new form of In-App Content) is developed, a profit-maximizing developer selects a price that maximizes expected profit over the long run, taking into account costs incurred over the long run.[880] To ensure a sufficient rate of return on its investment, a developer faced with the prospect of paying 30 percent of its revenue to Google in perpetuity will (all else equal) need to charge a higher price to consumers than a developer facing a lower take rate. Price stickiness implies that the initial price chosen for an App (or In-App Content) will influence subsequent pricing, and hence reinforces developers' incentives to select an initial price that takes all costs (including the take rate) into account. Because developer costs would have been permanently and substantially lower due to lower take rates, prices would have been permanently and substantially lower for all or almost all developers.[881] Thus, lower take rates would influence developer pricing from the inception of their Apps (or In-App Content).

E. Google Could Also Respond to Greater Competition By Increasing Its Customer Discounts Such as Play Points

371. In this Part, I demonstrate impact and damages using the Discount Model. The two-sided model for the Android App Distribution Market and the one-sided model for the In-App Aftermarket were used to determine competitive but-for take rates under the assumption that the locus of competition, absent the Challenged Conduct, would be on take rates. For example, the two-sided platform model assumes that Google's access charge to consumers was near zero (and actually negative) in both the actual and competitive but-for worlds. An alternative, plausible response to the elimination of Google's restrictions would be for Google to increase its loyalty points program for consumers to encourage their use of the Play Store and Google Play Billing rather than using any other competing source of Apps or In-App Content. An increase in Google's loyalty points would have the effect of reducing prices for purchases of Apps and In-App Content, without any requirement that developers steer consumers via discounting. Indeed, this form of

878. *See, e.g.,* Amos Tversky & Daniel Kahneman, *Judgment under Uncertainty: Heuristics and Biases*, 184 SCIENCE 1124, 1128 (1974) ("In many situations, people make estimates by starting from an initial value that is adjusted to yield the final answer…different starting points yield different estimates, which are biased toward the initial values. We call this phenomenon anchoring."). *See also*, Andrea Caceres-Santamaria, *The Anchoring Effect*, Federal Reserve Bank of St. Louis (2021), https://research.stlouisfed.org/publications/page1-econ/2021/04/01/the-anchoring-effect ("[I]t's the initial price a consumer is exposed to that becomes a consistent reference point when shopping around. The tendency for a person to rely heavily on the first piece of information they receive when making decisions is known as the anchoring effect…Anchoring plays a role in decisions that involve numerical values such as prices…Retailers are very aware that price anchors are an effective tool they can use in their pricing strategy.").

879. Singer Class Cert Report ¶¶226-227.

880. *Id*. ¶226.

881. Even if one assumes that some developers would not lower their prices in the competitive but-for world, consumers still would benefit from quality improvements in Apps and In-App Content that developers would be able finance due to lower costs from lower take rates. Standard economics shows that competition drives firms to make competitive investments in product quality to keep pace with rivals. *Id*. ¶233 (citing Department of Justice & Federal Trade Commission, *Horizontal Merger Guidelines* (2010), §10).

competition is how credit cards compete to retain customers (funded via interchange fees to merchants), and how global distribution systems compete to retain travel agents (funded by booking fees charged to airlines). In addition to serving as a means to compete for consumers, a subsidy to consumers by Google can also bring value to developers by encouraging consumer spending.[882]

372. Record evidence indicates that Google recognizes that the issuance (as opposed to the redemption) of Play Points confers value to the consumer. Google recognizes that, as a result of Play Points, "the customer is getting greater value[.]"[883] Google considers Play Points to be "a material right to the customer".[884] Google has likened Play Points to "other industry specific loyalty plans (hospitality, airlines)."[885]

373. Given the current lack of competition due to the Challenged Conduct, the size and scope of Google's Play Points program is fairly modest. Android users who signed up pre-2019 must opt in to Google Play Points.[886] In addition, not all Apps participated in Google Play Points.[887] According to one analyst, under the current configuration of the program, "the spend-to-earn ratio is so steep that you would have to spend a pretty unrealistic amount of money in the Google Play Store to get enough points to actually do anything."[888] Despite its modest size relative to Google's take rate, the structure of Play Points is a reasonable facsimile of what an expanded program might look like in a competitive but-for world. Google awards Play Points for: (1) any purchase; (2) participation in weekly promotions (essentially getting extra points for spending on particular top games); and (3) installing new Apps that Google selects.[889] The points can then be spent on (a) Play credits (money to buy games); (b) priced initial App downloads or In-App Content; or (c) discounts on In-App Content.[890] Consumers may also reach higher "tiers" as they accrue points, which gives them access to additional benefits.[891] More broadly, Google could adopt other methods (akin to Amazon Coins) for providing direct consumer discounts.

374. Record evidence reveals that Google committed to reducing App prices via enhancing its points program to combat the threat of platform entry, a threat that never fully emerged in the actual world. Lawrence Koh, former Global Head of Games Business Development at Google, testified that Google launched Play Points in response to the expectation of "increased competition in the marketplace for mobile App users[.]"[892] Google first introduced Play Points in

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882. GOOG-PLAY-002653782.R at -792.R ("Developers are realizing significant value from Play Points").

883. GOOG-PLAY-001557975 at -986.

884. *Id.* at -980 ("[T]he points program provides a material right to the customer that they would not receive without making a purchase on the Play Store. As a result, the points awarded through Play Store transaction are considered a separate performance obligation of the Play Store purchase.").

885. *Id.* at -977.

886. Jonathan Jaehnig, *What Are Google Play Points and How Can You Use Them?*, MAKE USE OF (Apr. 8, 2021), www.makeuseof.com/what-are-google-play-points/.

887. *Id.*

888. *Id.*

889. GOOG-PLAY-000518034.R. at -038.R.

890. *Id.*

891. *Id.* at -041.R.

892. Koh Dep. 353:1-18.

Japan, when it faced competition from Amazon.[893] Google noted that high valued users ("HVUs"), who accounted for half of all spending, presented a "churn risk."[894] It further noted that "Competitive Android stores such as Amazon App Store in Japan have reached 2-10% of developer revenue, mainly by attracting Play HVUs with heavy discounts (20 – 50% off)."[895]

375. Even under the limited competition that exists in the actual world, Google targeted more than just HVUs (high value users) with Play Points, and encouraged broad-based participation: "We plan to scale the program to reach [redacted] and develop additional ways for [redacted] to participate to achieve [redacted] enrolled members by the end of 2021."[896]

376. Record evidence indicates that uptake and usage of Play Points can be rapid when the program is made sufficiently generous. When Google launched Play Points in Japan, Google documents show that "rapid enrollment" resulted in "spend coverage of 50 percent" within just one year.[897] Moreover, Google "expect[ed] most buyers to spend their points within 2 months."[898]

377. Google next deployed the Play Points program in response to the ONE Store's entry in Korea. The ONE Store offered "cashback events," which amount to 30 to 50 percent of total transactions inside certain gaming Apps,[899] making points (rather than the take rate) the locus of competition. Google planned to combat ONE Store's [redacted] Google also noted that Samsung, through its Galaxy App store, was "courting developers via low 20% rev share."[901] In response to this dual threat in South Korea,[902] Google enhanced its own points program, launching in April 2019 and enrolling [redacted] upon launch.[903] By the end of 2020, Google was offering a Play Points subsidy worth approximately [redacted] in South Korea.[904] These examples

893. Google introduced its Play Points program in Japan in September 2018. *See* C. Scott Brown, *Google Play Points rewards program is real and in Japan right now,* ANDROID AUTHORITY (Sept. 18. 2018), www.androidauthority.com/google-play-points-rewards-905387/.

894. GOOG-PLAY-001284083.R at -086.R. A "churn rate" tells how many customers a company loses over a time period in percentage terms. The risk that a company will lose customers can be referred to as "churn risk." *See* Patrick Icasas, *Your Customer is a Churn Risk (And Here's How We Know),* Catalyst (July 12, 2021), *available at* catalyst.io/blog/your-customer-is-a-churn-risk-and-heres-how-we-know.

895. GOOG-PLAY-001284083.R at -086.R. Google also noted that Japan "might just be the start as Amazon (historically) tries different approaches in a market (usually for a couple of years) before scaling up and going global with services." GOOG-PLAY-000879194.R at -195.R.

896. GOOG-PLAY-000436278.R at -287.R.

897. GOOG-PLAY-000004957.R at -969.R.

898. *Id.*

899. *See* Kim Jung-Min & Chea Sarah, *One Store Gains Ground in Local Android App Market*, KOREA JOONANG DAILY (Dec. 2, 2020), koreajoongangdaily.joins.com/2020/12/02/business/industry/One-Store-app-market-Google/20201202175300439.html.

900. *Id*. at -437.R.

901. *Id*. at GOOG-PLAY-000953437.R.

902. GOOG-PLAY-000302766.R at -864.R (citing decline in new purchasers in South Korea as reason for launching loyalty program).

903. GOOG-PLAY-000518034.R at -045.R

904. GOOG-PLAY-002653782.R at -793.R. *See also* GOOG-PLAY-005708308.R.

indicate that Google could respond to the elimination of its anti-competitive restrictions with incentives and discounts to consumers.

378. In the United States, Google's Play Points program was more widely introduced alongside Project Hug as part of a larger effort to combat the threat of platform competition. In a document, Google strategized about what to do with [redacted] a holdout on Project Hug.[905] [redacted] wanted a reduced take rate in addition to the other incentives Google was offering.[906] Google discussed various options. One was to [redacted] Another was to [redacted] A third option was to [redacted] Under this third approach, "We should let [redacted] know that Google is willing to invest Play's entire 30% share back to users in order to keep the ecosystem safe & growing for all."[907] Put differently, to avoid competition by another App store, such as proposed by [redacted] Google cared so much about not having consumers leave the Play Store that Google was willing to [redacted]

379. Further, Google initially ceded to mobile carriers [redacted] percentage points of its 30 percent take rate (or [redacted] percent) to fend off platform competition. This suggests that Google would be willing to cede as much to consumers to fend off competition in a but-for world without Google's anticompetitive restrictions.

380. Even under the limited competition that exists the actual world, Play Points have no expiration date as long as a consumer remains active: "The points accumulated by a customer have an expiration of one year if no points activity has occurred (either use of points or dollar spend in the Play Store). In theory, as long as the customer is active, the points would never expire (perpetual)."[908]

381. Google's Class Certification expert, Dr. Burtis, has argued that my Discount Model fails "to consider that Google's Play Points program provides benefits to a relatively small percentage of U.S. consumers,"[909] as [redacted] of U.S. consumers participated in the program and [redacted] of U.S. consumers earned and redeemed Play Points."[910] That "only" [redacted] of U.S. consumers participated in Play Points in the actual world—when the benefits of Play Points are comparatively meager—is hardly evidence that participation in a more competitive but-for world would not be substantially greater. In addition, that "only" [redacted] of those who participated earned and redeemed Play Points in the actual world does not prove that a more generous program would not see more widespread redemptions. Consumers would have enhanced economic incentives to enroll and participate in a Play Points offering more valuable incentives in the but-for world, just as consumers have more incentives to participate in a more generous credit card rewards program than a less generous one. In a more competitive but-for world, Google would also be incentivized to facilitate consumer participation in Play Points or

905. GOOG-PLAY-007329029.
906. *Id.*
907. *Id.* at -030.
908. GOOG-PLAY-007861322 at -329. *See also* Google Play, *Google Play Points Terms of Service* (Nov. 1, 2019), https://play.google.com/about/points-terms/index.html.
909. Burtis Class Cert Report ¶358.
910. *Id.*
911. Equal to [redacted]

other direct consumer discounts. For example, consumers could be automatically enrolled in Play Points. Discounts could be automatically redeemed at the point of purchase or even dispensed through a "cash-back" program.[912]

382. It is also incorrect to assume that Play Points that are not redeemed have no value. *First*, Play Points that have not yet been redeemed today may still be redeemed in the future—in other words, they have an intrinsic option value, just as cash accumulating in a jar can be spent later. *Second*, that different consumers may value Play Points differently does not make them worthless. That different consumers may place different values on reward points, gift cards, or even money does not imply that they lack economic value.

383. As explained in Part VI.B.5.c, Amazon has offered substantial consumer subsidies through initiatives such as Amazon Coins. Record evidence indicates that approximately 90 percent of worldwide consumer expenditure in the Amazon Appstore is transacted using Amazon Coins.[913] This provides evidence that Play Points subsidies would be widely utilized in a more competitive but-for world.

384. To model the effect of an increased subsidy to consumers in a competitive but-for world, I once again use the Rochet-Tirole two-sided platform model. However, I now solve for a negative transaction price or subsidy to consumers in response to platform competition, assuming that the but-for take rate remains fixed at its observed average value of [redacted] percent. Under the current program, Google's Play Points can be applied to both initial App downloads and purchases of In-App Content—that is, Google does not have two different point programs.[914] It is reasonable to assume the structure of the program would remain the same in a competitive world, albeit with a larger subsidy for consumers, as Google would want to incentivize users to continue purchasing through its platform. Accordingly, I estimate the model only once to obtain a single subsidy in both markets as Google offers now. In contrast, above I estimated the competitive but-for take rate in the Android App Distribution Market separately from the competitive but-for take rate in the In-App Aftermarket, as nothing requires Google to charge the same take rate in those separate markets. My use of the Rochet-Tirole model to estimate a competitive but-for subsidy that can be spent on initial paid App downloads or In-App Content should not be taken to mean that the In-App Aftermarket is a two-sided antitrust market nor that the two separate antitrust markets are suddenly unified. Put differently, that I use the two-sided model to estimate a *single* consumer subsidy across both initial paid App downloads and purchases of In-App Content—a subsidy model that Google uses today and might use in a competitive but-for world—has no bearing on whether the In-App Aftermarket is one-sided or two-sided.

385. Holding the take rate fixed at the observed monopoly level, a monopoly platform operator would maximize its profits by setting the buyer-side platform price P_B such that the following equation is satisfied:

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912. *See, e.g.,* Discover, Discover it Cash Back Card, https://www.discover.com/credit-cards/cash-back/it-card.html

913. [redacted]

914. For this reason, the model can be applied whether there is one market, or whether there is a separate aftermarket.

(V.11)
$$\frac{P_B + tS - C}{S + P_B} = \frac{1}{\varepsilon_B}$$

where ε_B is the price elasticity of demand from buyers for paid App downloads or In-App Content.[915] In the presence of competition, the platform operator would maximize profits with respect to its residual demand curve (market demand net of demand that is competed away by rivals), yielding the competitive analogous expression:

(V.12)
$$\frac{P_B + tS - C}{S + P_B} = \frac{1}{\varepsilon_{OB}}$$

where ε_{OB} is the own-brand price elasticity of demand from buyers for paid App downloads or In-App Content.[916]

386. My sources and methods for obtaining the monopoly scenario inputs shown in Equation (V.11) are:

- P_B^M is equal to the price "charged" by Google to consumers for each transaction made on its platform in the monopoly scenario. Through its Play Point loyalty program and other promotions, Google effectively charges a small negative price to consumers. I compute the average value of this subsidy as the sum of all promotions paid by Google for transactions made in both the Android App Distribution Market and In-App Aftermarket, divided by the total quantity of paid Apps downloaded in the Android App Distribution Market and purchases of In-App Content in the In-App Aftermarket, as observed in Google's transaction records.

- t is equal to the observed take rate, computed as the sum of all revenue retained by Google in both the Android App Distribution Market and In-App Aftermarket divided by the sum of total revenue spent by consumers in both the Android App Distribution Market and In-App Aftermarket (prior to Google's promotional expenditures, which are captured by P_B^M).

- S is equal to the average price charged for paid Apps in the Android App Distribution Market and In-App Content in the In-App Aftermarket in the monopoly setting.[917] I calculate S as the total amount of revenue spent by consumers (prior to receiving promotions from Google) in both the Android App Distribution Market and In-App Aftermarket divided by the total quantity of paid Apps downloaded in the Android App Distribution Market and purchases of In-App Content in the In-App Aftermarket, as observed in Google's transaction records.

- Marginal cost C represents the incremental cost incurred by Google of executing a transaction in the Android App Distribution Market or In-App Aftermarket. I refer to

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915. Details of how Equation (V.11) is derived are provided in Appendix 3.
916. Details of how Equation (V.12) is derived are provided in Appendix 3.
917. Apps that are free to download and free In-App content have a zero price and are therefore excluded from the analysis.

Google's financial data to infer this value, which suggests that transaction fees, customer support, and other fees are equal to [redacted] percent of consumer expenditures.[918]

- ε_B^M is the buyer-side price elasticity of demand for paid Apps in the Android App Distribution Market and In-App Content in the In-App Aftermarket. ε_B^M reflects the change in the quantity demanded by consumers for Android App Distribution Market or In-App Aftermarket transactions associated with a change in the price of the App or in-App product $S^M + P_B^M$ (inclusive of the buyer-side platform price).[919] Given the other inputs to the monopoly model, the value of ε_B^M is implied by Equation (V.11).

I hold C fixed across the monopoly and competitive scenarios. Because I am modeling competition on the buyer-side consumer price, I hold the developer-side take rate t fixed between scenarios also. Holding t fixed implies no change in the (pre-subsidy) product price S between scenarios. My sources and methods for obtaining the remaining inputs to the competitive scenario expression shown in Equation (V.12) are:

- P_B^C is the competitive buyer-side price charged by Google for each transaction on its platform. Using the other inputs to the model, Equation (V.12) allows me to solve for P_B^C.

- ε_{OB}^C is the "own-brand" price elasticity of demand for paid Apps in the Android App Distribution Market and In-App Content in the In-App Aftermarket by consumers in the presence of competition. ε_{OB}^C reflects the change in the quantity demanded from consumers for Android App Distribution Market and In-App Aftermarket transactions—from Google in particular, hence, "own-brand"—associated with a change in App prices. Relative to its monopolistic analogue, this parameter reflects a scenario where Google faces competition from rival platforms; as such, the parameter will be greater in magnitude, because the presence of platform competition allows easier defection from consumers in the presence of a product price increase. I draw from the economics literature empirical evidence of industries that have shifted from monopoly to competition. I conservatively estimate that the buyer-side price elasticity of demand faced by Google shifts from a value of [redacted] (in the monopoly setting, as calculated using Equation (V.11)) to [redacted] in the competitive setting. I arrive at [redacted] using the relation between own-brand elasticity and market demand elasticity under the conservative assumption that Google maintains a 60 percent market share with an inelastic supply response from Google's rivals.[920] Further description of this input is included in Appendix 3.

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918. *See* work papers for this report.

919. ε_B^M (which reflects consumer sensitivity to the total product price including buyer-side platform price, $P_B^M + S^M$) differs from, but is related to, the take rate buyer elasticity $\varepsilon_{B,t}^M$ (which reflects consumer sensitivity to the take rate, effectuated via pass-through) that is referred to in Section V.A.3. Further description of these parameters can be found in Appendix 3.

920. I use the relation $E_g = \frac{E_M}{S_g} + \frac{E_S(1-S_g)}{S_g}$ where E_g is Google's own-brand elasticity (reflecting price responses of both buyers and sellers), E_M is market elasticity, S_g is Google's market share, and E_S is the elasticity of supply of Google's rivals. I conservatively assume Google maintains a 60 percent market share and that $E_S = 0$. This implies that buyer price elasticity of demand changes from [redacted] in the monopoly setting (estimated using Equation (V.11)) to [redacted] *See, e.g.,* Landes & Posner.

TABLE 16: DISCOUNT MODEL (U.S., 8/16/2016 – 5/31/2022)

#	Input	Description	Value	Source/Notes
Actual World (Monopoly, Eqn. (V.11))				
#	**Input**	**Description**	**Value**	**Source/Notes**
[1]		Consumer Expenditure (US; Before Discounts)	[redacted]	GOOG-PLAY 005535886; Google Transaction Data (US Consumers)
[2]		Google Revenue (US; Before Discounts)	[redacted]	*Id.*
[3]		Google Promotional Expenditures (US)	[redacted]	*Id.*
[4]		Android App Distribution (Paid) and In-App Aftermarket Transactions (US)	[redacted]	*Id.*
[5]=[1]/[4]	S	App Product Price	[redacted]	Calculated
[6]=[2]/[1]	t	Take Rate	[redacted]	Calculated
[7]=-[3]/[4]	P_B^M	Buyer-side Platform Price	[redacted]	Calculated
[8]=[5]+[7]	$S + P^M_B$	App Product Price Net of Discounts	[redacted]	Calculated
[9]	C	Marginal Cost	[redacted]	GOOG-PLAY-000416245; GOOG-PLAY-010801682
[10]	ε^M_B	Buyer Price Elasticity of Demand	[redacted]	Calculated (Eqn. (V.11))
But-For World (Competitive, Eqn. (V.12))				
#	**Input**	**Description**		**Source/Notes**
[11]=[5]	S	App Product Price	[redacted]	Calculated (Eqn. (V.8))
[12]=[6]	t	Take Rate	[redacted]	Calculated
[13]	P_B^C	Buyer-side Platform Price	[redacted]	Calculated (Eqn. (V.12))
[14]=[11]+[13]	$S + P^C_B$	App Product Price Net of Discounts	[redacted]	Calculated
[15]=[9]	C	Marginal Cost	[redacted]	GOOG-PLAY-000416245; GOOG-PLAY-010801682
[16]	ε^C_{OB}	Buyer Own-Price Elasticity of Demand	[redacted]	Economic theory/empirical studies
[17]=[8]-[14]		Consumer Savings Per Transaction	[redacted]	Calculated
[18]=[17]*[4]		**Aggregate Damages**	[redacted]	Calculated

Notes: *See* notes for Table 6, *supra*.

387. Table 16 above summarizes the inputs and resulting buyer-side platform price, and calculates aggregate damages. Table 16 shows calculations made with respect to transactions in both the Android App Distribution Market and the In-App Aftermarket combined; the inputs will therefore vary from those used in Table 6. According to this model, Google would provide a direct consumer discount, either through expanding the Play Points program or by providing a similar economic benefit, worth an average of [redacted] per transaction, or approximately [redacted] percent of consumer spend (in the competitive but-for world).[921] Because this is a direct subsidy to consumers, there is no need to estimate a pass-through model to establish antitrust impact. As Table 16 shows, the resulting but-for average price of paid App downloads in is [redacted] down from

921. Equal to the [redacted] divided by the product price of [redacted]

the observed price of [redacted] (net of Google's promotional expenditures to consumers). This difference results in an average overcharge to consumers of [redacted] and aggregate damages of [redacted] billion as a result of the Challenged Conduct for the time period August 16, 2016, through May 31, 2022 for the U.S.

388. In the actual world, Google awards Play Points to members of the program in proportion to their purchases made in the Play Store; any customer can enroll in Play Points free of charge. In the but-for world, awarding Play Points in proportion to all purchases made by U.S. Consumers, including purchases made by members of the Damages Class, implies lower prices in the but-for world relative to the actual world, and therefore common impact on all or virtually all members of the Damages Class.

F. A Rigid Pricing Structure Ensures That U.S. Consumers Would Benefit From The Removal of the Challenged Conduct

389. Google's commission structure affects all paid Apps and purchases of In-App Content by taking a fixed percentage. Moreover, while developers set different prices for their Apps and In-App Content, these differences do not vary by customer. Eliminating the Challenged Conduct would introduce competition driving the commission rate lower or resulting in further subsidies to consumers by enhancing loyalty programs. Enhanced loyalty programs again would not lead to differential prices across different consumers. Both lower commission rates and enhanced loyalty programs would therefore benefit all U.S. Consumers.

390. This is true even when a U.S. Consumer purchases from a developer that has received a discount off Google's standard take rate in the actual world. In the actual world, Google has imposed a headline take rate of 30 percent nearly universally, with the following exceptions: (1) a 15 percent take rate rolled out in 2018 for subscription Apps (initially only for subscribers after their first year; more recently for all subscribers); (2) a 15 percent take rate charged for the first $1 million of sales (starting July 2021); and (3) instances where developers were able to negotiate a lower take rate. Nevertheless, Google's overall take rate has been at or very close to 30 percent for the vast majority of consumer expenditures: Google's data show that Google has collected commissions in excess of [redacted] of consumer expenditures in both the Android App Distribution Market and the In-App Aftermarket.[923]

391. To the extent that some developers received discounts from Google's 30 percent take rate in the actual world, such discounts would be similarly negotiated in the competitive but-for world.[924] Moreover, a Google witness has testified that although Google has offered lower take rates for "some programs for certain categories of developers…we don't, outside the context of those programs, wouldn't be negotiating it individually with developers on rev share."[925] This pricing structure, and Google's policy limiting negotiation of take rates with individual developers,

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922. Equal to [redacted]

923. *See* Table 6, *supra*, Row 6; *see also* Table 8, *supra*, Row 3.

924. Hal J. Singer and Robert Kulick, *Class Certification in Antitrust Cases: An Economic Framework*, 17 GEORGE MASON LAW REVIEW (2010); Hal Singer, *Economic Evidence of Common Impact for Class Certification in Antitrust Cases: A Two-Step Analysis*, 25(3) ABA'S ANTITRUST (2011).

925. Rosenberg Dep. 123:22-124:23 (further testifying that "We had – we had interest in advancing the ecosystem as a collective, and so that was a principle from the beginning").

implies class-wide impact, as all or almost all developers would pay a lower take rate in a more competitive world, and would pass on a portion of the savings to all or almost all U.S. Consumers.[926] In Part VII below, I show how to compute damages for individual U.S. Consumers based on their purchases.

G. Lower Prices Would Enhance Demand for Apps and In-App Content and Lower Take Rates Would Enhance the Supply of Apps and In-App Content Leading To Increased Output Relative to the Actual World

392. A foundational principle in economics is that "demand curves" are downward sloping—meaning that, all else equal, consumers will demand more of a product or service the lower its price.[927] How much more will be demanded depends on the consumer elasticity of the demand response to lower prices for Apps and In-App Content. As developers steer consumers to lower-cost App stores or payment processors in the but-for world via lower prices, consumers would respond by making more paid App downloads and purchases of In-App Content. This phenomenon can be understood graphically as a movement down the demand curve, resulting in higher output.

393. In a similar vein, the supply of Apps and In-App Content would increase as developers receive more for their Apps and In-App Content. Currently, developers receive only approximately 70 percent of the revenues generated from paid Apps and In-App Content in light of Google's take rate. Absent the Challenged Conduct, developers would realize larger proceeds, which would bring forward more App and In-App Content development, commensurate with a shifting out of the supply curve. Indeed, Google recognized that take-rate reductions, leading to higher revenues (price less commission) paid to developers, could increase output: In announcing its reduction in its commission to 15% for the first $1 million in revenue, Google's Vice President of Product Management explained that the new policy would provide "funds that can help developers scale up at a critical phase of their growth by hiring more engineers, adding to their marketing staff, increasing server capacity, and more."[928] When the ONE Store reduced its take rate, it reported substantial increases in both the number of Apps and in transaction volumes.[929]

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926. To illustrate, suppose that Google's overall take rate falls from 30 percent in the actual world to 20 percent in the but-for world. A developer paying a 15 percent take rate in the actual world would pay a take rate of 10 percent in the but-for world (equal to 15*(20/30). This lower take rate would then be passed on to U.S. Consumers in the form of lower prices.

927. *See, e.g.,* GEORGE STIGLER, THE THEORY OF PRICE 23 (McMillan 3rd ed. 1987) ("The 'demand curve' is the geometrical expression of the relationship between quantity purchased and price, and our law of demand says that demand curves have a negative slope.").

928. Sameer Samat (Google Vice President, Product Management), *Boosting Developer Success on Google Play* (Mar. 16, 2021), android-developers.googleblog.com/2021/03/boosting-dev-success html.

929. *See, e.g.,* One Store, *One Store wins by cut fees* (Sep. 5, 2018), onestorecorp.com/news/presskit/2018/2018-09-05 html ("One Store has revealed the two-month interim performance of the announcement of a new App distribution policy, including a 25% cut in fees in July of this year. [CEO] Jaehwan Lee announced that compared to before the policy change, the number of newly registered app/game products increased by about 30% and the total transaction amount increased by 15%.") (English translation by Google Translate). *See also* Korea JoongAng Daily, *One Store gains ground in local Android App market* (Dec. 2, 2020), koreajoongangdaily.joins.com/2020/12/02/business/industry/OneStore-app-market-Google/20201202175300439.html ("Since July 2018, One Store lowered its commission fee to 20 percent from 30

394. There is no reason why the markets for Apps and In-App Content are any different from other markets where demand increases as prices fall. Indeed, my estimated elasticities of demand confirm this relationship. Accordingly, a reduction in the prices to consumers of Apps and In-App Content, which would result from a removal of Google's anti-competitive restrictions in the two relevant antitrust markets, would translate directly into enhanced demand for Apps and In-App Content. Given the digital nature of the products in both markets and thus the largely fixed cost of supplying both products[930]—the initial App and In-App Content—increased demand would translate into additional output for both products.

395. To show the output effect for each year in the Class Period from 2016 through 2022 (the latest available annual data), I begin with the aggregate commissions paid by developers to Google. The average actual take rates on paid downloads in the Android App Distribution Market was [redacted] and the average actual take rates on paid purchases of In-App Content was [redacted] According to my two-sided market model, the average competitive take rate in the Android App Distribution Market would be [redacted] According to my economic model, the average competitive take rate in the In-App Aftermarket would be [redacted]

396. These lower take rates translate into lower costs for developers. For example, as seen in Table 8, in the In-App Aftermarket the Play Store's price per transaction to developers would decline from [redacted] in the actual world to [redacted] per transaction in the but-for world, for total savings of [redacted] per transaction. Consumers would also benefit because [redacted] percent of these savings would be passed on in the form of lower prices. Developers and consumers would also benefit from lower costs in the Android App Distribution Market, as seen in Table 6.

397. To convert these price reductions into output effects, I conservatively apply the estimated market price elasticity of [redacted] shown in Table 8. For every one percent decrease in Google's price, demand increases by [redacted] percent. For example, a ten percent decrease in the transaction price would increase transaction demand by [redacted] percent.

398. Because the counterfactual experiment lies at the heart of antitrust analysis,[931] which involves comparing actual output against output but for the Challenged Conduct, output effects can occur even against a background of expanding output in the relevant market.[932] Output effects here take the form of fewer Apps downloaded and fewer purchases of In-App Content than would have otherwise occurred. Because the demand for such goods falls as their prices rise (that

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percent on all in-App purchases. Starting October this year, it has also been offering 50 percent discounts on commission fees for businesses with monthly transactions under 5 million won. Google Korea's recent announcement that it would force a 30 percent commission fee on all in-App purchases is another driving force behind One Store's fast growth. Local App developers who were upset with Google's decision are turning their eyes to One Store as an alternative.").

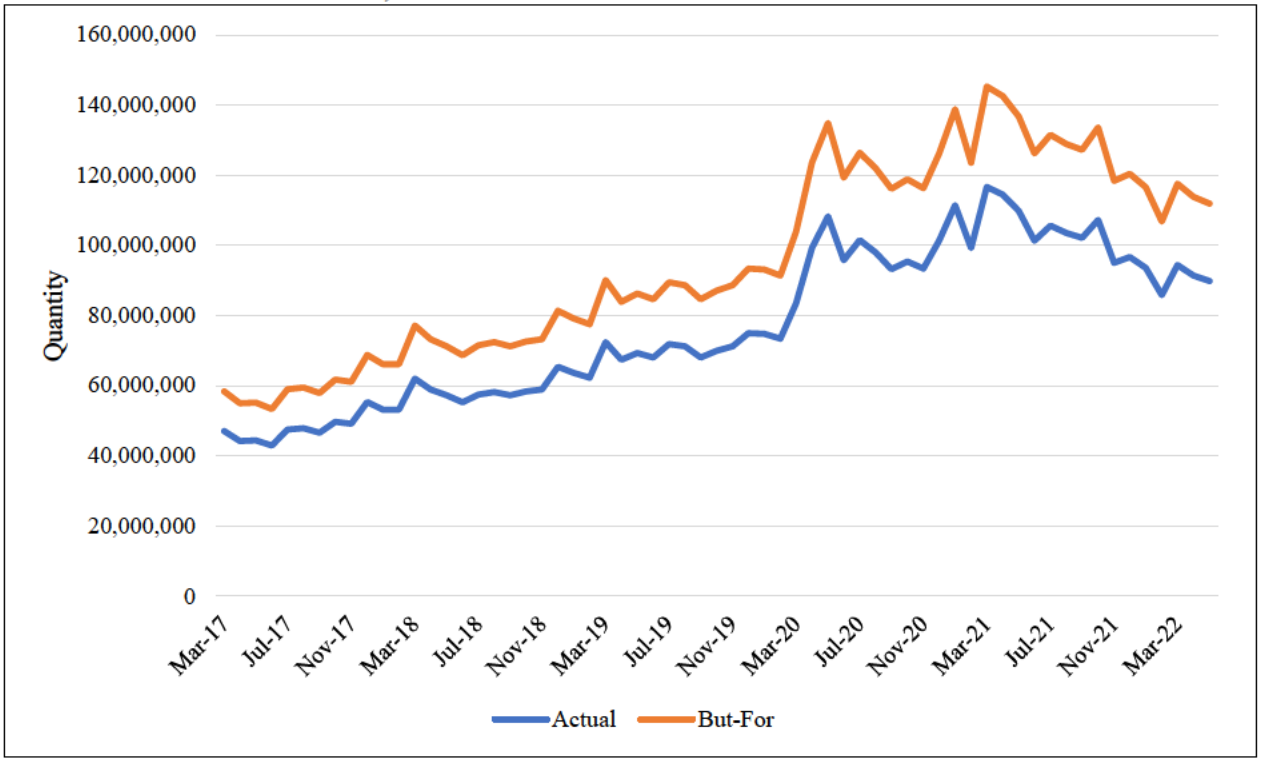
930. The marginal cost is the developers' marginal cost, plus the marginal cost of the record keeping, server hosting, auto updating, security, and authorization services that Google currently performs.

931. Theon van Dijk & Frank Verboven, *Quantification of Damages*, in 3 ISSUES IN COMPETITION LAW AND POLICY 2331, 2332 (ABA Section of Antitrust Law 2008) ("The difference between this counterfactual world and the actual world provides the measurement of damages.").

932. John Newman, *The Output-Welfare Fallacy: A Modern Antitrust Paradox*, 107(2) IOWA L. REV. 563, 579 (2022) (explaining the "The trial court found that AmEx's no-steering rules had increased retail prices for nearly every consumer product sold in the United States (among other ill effects)," implying output effects per the appropriate counterfactual exercise).

is, the demand curves slope downward), it follows that output contracted, even though in the In-App Aftermarket we observe output increasing over the Class Period. In other words, the but-for competitive output curves sit strictly above the actual output curves, illustrated below. This holds true for all of my economic models of a competitive but-for world. Below I conservatively calculate output effects based on the demand elasticity of [redacted] in Table 8. Using this elasticity, output is estimated to increase by approximately [redacted] in the but-for world, as seen below.[933]

FIGURE 20: OUTPUT EFFECTS, ANDROID APP DISTRIBUTION MARKET AND IN-APP AFTERMARKET



Sources: Play Store financials; Google Transaction Data; Tables 6 and 8.

399. In addition to these direct output effects, the but-for world is likely to be characterized by increased innovation by software developers, which would redound to the benefit of consumers in the form of enhancements to quality, quantity, and consumer choice in both the Android App Distribution Market and In-App Aftermarket. For example, lower take rates would allow developers to reinvest to improve their products by "hiring more engineers, adding to their marketing staff, increasing server capacity, and more," just as Google recognized in launching its reduction in take rate for the first $1 million in developer revenue.[934] Record evidence indicates that Google was optimistic about the impact of a reduced take rate on developers, with one

933. For the App/In-App models, I estimate that output would increase by approximately [redacted] driven by a decrease in the take rate to approximately [redacted] (equal to the weighted average across the Android App Distribution Market and the In-App Aftermarket). For the Discount Model, I estimate that output would increase by approximately [redacted] driven by the increase in consumer discounts. For the Single Take Rate model, I estimate that output would increase by approximately eleven percent, driven by a decrease in the take rate to [redacted] percent. *See* work papers for this report.

934. Sameer Samat (Google Vice President, Product Management), *Boosting Developer Success on Google Play* (Mar. 16, 2021), android-developers.googleblog.com/2021/03/boosting-dev-success html.

executive writing that "we're confident that this investment back into the developer community, particularly smaller ones, will lead to increased innovation, resulting in more choice and lower price for users."[935] Increased competition would also allow developers to meaningfully improve the quality of their payment solutions. Even YouTube, which used its own billing system instead of Google Play Billing, recognized that integrating Google Play Billing "limits innovation in relation to billing."[936]

H. In the Competitive But-For World, Google Would Still Make a Profit from the Play Store

400. Eliminating Google's anticompetitive restraints would allow developers to use alternative App stores and be free from the first download onward to choose a payment processor and other suppliers of services that support the purchase of In-App Content. *Ex ante* competition to be an alternative source of Apps or to become a default payment processor for a developer would result in more competitive take rates. And lower take rates would redound to the benefit of consumers in the form of lower prices, as developers competed for the loyalties of consumers.[937] If Google responded to increased competition by increasing consumer discounts, consumers would benefit directly from the discounts. As explained in the previous section, output would increase in the but-for world. This would serve to partially offset the effects of lower take rate and of the Play Store's diminished market share. I understand that Mr. Chase has calculated the Play Store's but-for profit after taking these effects into account, and that his analysis confirms that the Play Store would indeed remain profitable in the but-for world under the App-In/App models, the Discount Model, the Single Take Rate Model, and the Amazon Discount Model.[938]

A. In the Absence of the Challenged Conduct, Google Would Refrain from Imposing a Fee on Consumers for Initial Downloads, Including on Free Apps

401. Because a large user base is critical, two-sided digital platform operators, such as Google, are often incentivized to provide free access to users or even to subsidize access to users.[939] This approach allows two-sided digital platforms to get "both sides on board." Encouraging use of the platform by one group may come at a cost to the platform operator, but it serves to attract the group on the opposite side of the platform.[940] In the instant setting, allowing consumers to browse

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935. GOOG-PLAY-002358233 at -236.

936. GOOG-PLAY-001088593 at -596.

937. In the face of regulatory pressure, Google recently announced that it will it allow users in South Korea to use different in-App payment options, including in-App payment systems developed by App developers; Google will consequently decrease its take rate by four percentage points (from 15 percent to 11 percent). *See* Nathaniel Mott, *Google Decides to Obey South Korea's In-App Payment Law*, PCMAG (Nov. 4, 2021), pcmag.com/news/google-decides-to-obey-south-koreas-in-app-payment-law. In the competitive world contemplated here, Google would not be able to impose a take rate on in-App transactions unless Google were selected to be the payment processor by the developer.

938. Expert Report of Michael H. Chase, CPA, CFF, ABV (Oct. 3, 2022), ¶9.

939. *See, e.g.,* Thomas Eisenmann, Geoffrey Parker, and Marshall W. Van Alstyne, *Strategies for Two-Sided Markets*, HARVARD BUSINESS REVIEW 3-4, (2006) ("Because the number of subsidy-side users is crucial to developing strong network effects, the platform provider sets prices for that side below the level it would charge if it viewed the subsidy-side as an independent market."). *See also* Mark Armstrong & Julian Wright, *Two-sided markets, competitive bottlenecks and exclusive contracts*, 32 ECONOMIC THEORY 353-380, 359 (2007) ("If attracting one group (say buyers) makes the platform particularly attractive to the other group (say sellers), then buyers will be 'subsidized.'").

940. Rochet & Tirole at 991 (2003).

the Play Store for free and download free Apps creates a benefit to Google above the cost to create and maintain the App store due to the indirect network effects in attracting more developers and additional money Google can make by attracting advertisers.[941] Google's network-driven incentive to "capture" as many users as possible by drawing them into the Google ecosystem (including the GMS suite) would not change in the absence of its anticompetitive conduct. Google would continue to benefit from indirect network effects even without its various restrictions—the more Apps it can attract, the more consumers will come to its platform—although its take rates on positively-priced Apps would be lower. However, any reduction in revenue from a lower take rate would be more than offset by the advertising revenue generated from maintaining its user base. Google also would continue to obtain information about users, just as it does from its other Apps in its GMS suite, which Google monetizes through the delivery of targeted ads to users.

402. Accordingly, Google likely would not impose even a modest fee on consumers for downloads of free Apps. Any attempt by Google to impose a transaction fee on consumers for free downloads would run counter to the company's basic business model and history to provide a widening array of free Apps or functionalities—such as Search, Maps, Gmail, You Tube, Chrome, and other Apps in its GMS suite—to consumers, but then collecting and monetizing information from consumers to realize and improve Google's targeted digital advertising. Imposing a fee on initial downloads would discourage consumers from downloading Apps through the Play Store, which in turn would jeopardize advertising revenues from the Play Store. Indeed, in 2020, Google earned [redacted] in the sale of ads that appeared in the Play Store, with almost all of those revenues falling to the bottom line.[942] Having more users on the Play Store lifts Google's advertising revenues above and beyond those earned on the Play Store, as those users are more inclined to remain in an Android environment, supporting other Google Apps. Moreover, the form-of-payment information, including a user's billing address, provides further personal identifying information for Google's advertising businesses. Advertising across the entire suite of Google's offerings accounts for over 80 percent of Google's total revenues.[943] By imposing a download fee on free Apps, Google would lose advertising revenue as some consumers ceased to use the Play Store and some advertisers would then not pay as much for ads or would stop advertising.[944]

403. Moreover, many Apps may be considered "experiential products,"[945] meaning that a consumer cannot discover its usefulness until they have downloaded the App and explored its functionalities. Imposing a fee on formerly free Apps would undermine this discovery process and thereby lower the value of the Play Store for consumers. Discouraging consumers from installing new Apps would also undermine the indirect network effects that Google is trying to harness—namely, a large customer base that attracts more developers to its platform and generates more

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941. Android was founded on this premise. *See* GOOG-PLAY-001055695 at -697 (Android founder Andy Rubin in October 2009: "The reason Google is building Android is so it can benefit from the advertising revenue generated by consumers using their phones to do searches[.]").

942. GOOG-PLAY-001090227.

943. Statista, *Advertising revenue of Google from 2001 to 2021*, statista.com/statistics/266249/advertising-revenue-of-google/ ("In 2021, Google's ad revenue amounted to 209.49 billion U.S. dollars…Advertising accounts for the majority of Google's revenue, which amounted to a total of 256.73 billion U.S. dollars in 2021."). *See also* GOOG-PLAY-004113976.R at -979.R (2015 presentation showing that "Core Ads" were responsible for 87 percent of total revenue).

944. Rosenberg Dep. at 410:8-413:14.

945. *See, e.g.*, Allison Kidd, *Technology experiences: what makes them compelling?*, HPLabs Technical Report (2001).

advertising revenue. Google would still have an incentive to provide consumers access to free Apps (to try the Apps) because that is what sells the Apps and leads to purchases of paid In-App Content. In this respect, developers' and Google's incentives are aligned, competitive take rate or not. There is no reason to believe the business model of free initial App downloads would be eliminated because both Google and developers still want consumers to try and get hooked on Apps.

404. When Google cut its take rate from 30 percent to 15 percent for subscriptions longer than a year in 2018, or for all subscription revenue in 2022, it did not seek to offset the lost revenue by charging for Apps that were once free. Similarly, Google did not announce any increase in the take rate in the Android App Distribution Market in conjunction with its plans to offer a 15 percent take rate on the first $1 million in revenue for all developers in 2021. This evidence suggests that, in the competitive but-for world where Google would have to lower its take rate due to competition, it would still not seek to offset the lost revenue by charging consumers for downloading previously free Apps.

J. Focal-Point Pricing Does Not Undermine Classwide Impact

405. The use of focal-point pricing, using "customary prices" such as those ending in "99," would not undermine classwide impact.[946] First, developers are willing to prominently display non-focal-point prices to consumers.[947] Further, developers are willing to charge prices that violate the "99 rule" when passing on marginal cost savings from lower take rates to their customers. To illustrate, suppose that a developer has consistently charged $1.99 for In-App Content in the actual world due, in part, to focal-point pricing. Google would have kept $0.597 per transaction (equal to 30 percent of $1.99), remitting the remainder to the developer. Steering is prohibited for this developer in the actual world. The gross margin on each in-App transaction (before considering other marginal costs) is $1.39 (equal to $1.99 less $0.597). In a but-for world, a new payment processor (such as Paddle) emerges due to the elimination of the Aftermarket Restrictions and charges a ten percent take rate, which for this developer, would be $0.199 at the original price of $1.99. With steering permitted, the developer can realize cost savings of $0.398 per transaction (equal to approximately $0.597 less $0.199), but only if the developer can induce its customers to use the new payment processor rather than Google Play Billing. At this point, it is now profit-maximizing for the developer to deviate from focal-point pricing and share a portion of the savings with its customer via a lower price for in-App purchases. For example, the developer could drop its price for In-App Content made via the new processor to (say) $1.79, effectively splitting the savings with the customer for making the right choice. The developer's fee to the third-party payment processor falls to $0.179 per transaction (equal to 10 percent of $1.79). The developer's new gross margin (before considering other marginal costs) on transactions processed via the third-party processor is $1.61 (equal to $1.79 less $0.179), which exceeds the prior gross margin of $1.39. It no longer pays to abide by focal-point pricing. A key reason we do not see as much deviation from focal-point pricing in the actual world is that developers are not afforded the

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947. Of the 200 "Top paid apps" in the Play Store, 43 of them (or 21.5 percent) have initial download prices that do not end in "99." *See* backup materials to this report. *See also* Top Paid Apps, Google Play, https://play.google.com/store/apps/collection/cluster?clp=0g4jCiEKG3RvcHNlbGxpbmdfcGFpZF9BUFBMSUNBVElPThAHGAM%3D:S:ANO1ljLdnoU&gsr=CibSDiMKIQobdG9wc2VsbGluZ19wYWlkX0FQUExJQ0FUSU9OEAcYAw%3D%3D:S:ANO1ljIKVpg.

opportunity to steer due to the Aftermarket Restrictions. Moreover, in the few episodes where we do observe steering in the actual world, developers have been observed to deviate from 99-cent pricing increments, as shown in Table 9 of the Singer Class Cert Report.

406. Moreover, Google *required* developers, until very recently, to charge at least 99 cents. Thus, for a large number of developers, the observed prices in the actual world could be the result of a restraint that Google imposed on their pricing. Record evidence indicates that developers requested (and ultimately received) increased pricing flexibility, eventually persuading Google to abandon its $0.99 pricing floor, so that they could deviate from $.99.[948] That Google imposed a 99-cent restriction on developers implies that Google believed developers would deviate from such pricing.

407. To the extent developers would prefer to maintain "supermarket-style" pricing in the but-for world, they could do so simply by ending their prices in "9," instead of "99" (e.g., $2.49), or in or in "5" (e.g. $4.95) as many do today.[949] (Thus, the solution above to my hypothetical example of steering was $1.79, twenty cents below $1.99, but still ending in a nine.) Sellers' strategy of ending prices in "9" or "5", such as $2.99 or $2.95" is commonly known as "odd pricing," "psychological pricing," or "charm pricing." The strategic reasoning that underlies this practice rests on the belief that consumers will focus on the numbers to the left of the decimal, thus demonstrating higher demand for a good priced at $2.99 than $3.00, despite the negligible price difference of one cent. The economic literature has classified odd prices to include those within 5 cents of the nearest highest dollar (.95 to .99) or one cent below the next highest ten cents (.19, .29, etc.).[950] Market practitioners sometimes apply the same heuristic, underscoring the fact that odd pricing does not limit itself only to prices ending in "99."[951] Nothing would prevent developers from setting prices at $1.79 versus $1.99, for example, as a result of a decrease in the

948. *See* GOOG-PLAY-000355570.R at GOOG-PLAY-000355597.R ("From the developers perspective, they want more flexibility around their pricing. Many Developers that tested sub dollar pricing find this strategy effective, and they have asked us to expand the sub dollar capability to more markets."). The Play Store ultimately removed its $0.99 minimum pricing rule in our around early 2022. Archived web pages show that the Play Store had a U.S. minimum price of $0.99 as of late 2021. Play Console Help, Supported Locations for Distribution to Google Play Users, accessed Dec. 27, 2021, https://web.archive.org/web/20211227224037/https:/support.google.com/googleplay/android-developer/answer/10532353?visit_id=637762416354084080-1400722469&rd=1. As of mid-February 2022, the minimum price is listed at $0.05. Play Console Help, Supported Locations for Distribution to Google Play Users, accessed Feb. 18, 2022, https://web.archive.org/web/20220218131358/https:/support.google.com/googleplay/android-developer/answer/10532353?visit_id=637807868385671271-2942202130&rd=1.

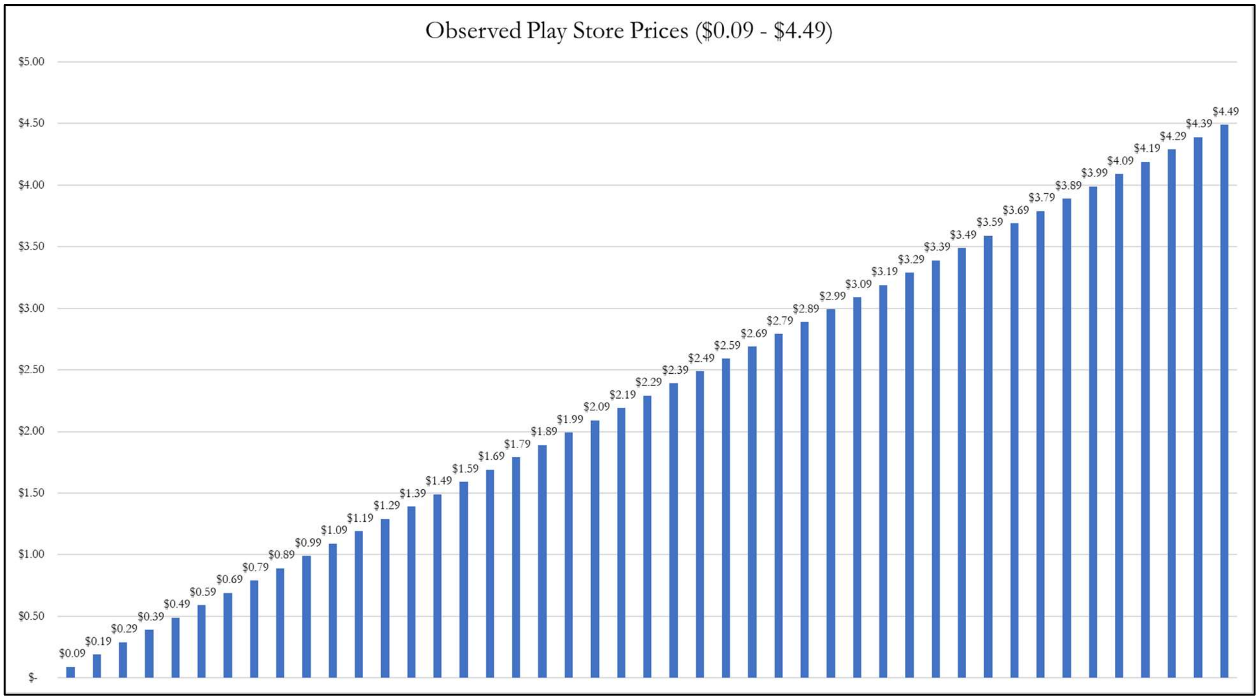
949. *See, e.g.*, Google Play, Top Paid, https://play.google.com/store/apps (press "Top Paid" button) (showing various "Top paid Apps" with prices that do not end in "99." For example, as of April 21, 2022, the third most-popular paid App was "Torque Pro (OBD 2 & Car)," priced at $4.95 per download on the Play Store. Another paid App in the Top 20 was "Tasker," priced at $3.49 per download on the Play Store).

950. Judith Holdershaw, Philip Gendall and Ron Garland, *The Widespread Use of Odd Pricing in the Retail Sector*, MARKETING BULLETIN, 8, 1997, 53-58, Research Note 1, marketing-bulletin massey.ac nz/V8/MB_V8_N1_Holdershaw.pdf

951. *See* PriceIntelligently, Odd-Even Pricing, priceintelligently.com/odd-even-pricing# ("Odd pricing refers to a price ending in 1,3,5,7,9 just under a round number, such as $0.19, $2.47, or $64.93"). *See also*, Shopify, Odd-Even Pricing, shopify.com/encyclopedia/odd-even-pricing ("Odd-even pricing is a pricing strategy involving the last digit of a product or service price. Prices ending in an odd number, such as $1.99 or $78.25, use an odd pricing strategy, whereas prices ending in an even number, such as $200.00 or 18.50, use an even strategy").

take rate. As illustrated in Figure 21 below, "supermarket pricing" is already observed in the Play Store, with prices at regular, ten-cent intervals.

FIGURE 21: PLAY STORE TRANSACTION PRICES AT TEN-CENT INTERVALS ($0.09 - $4.49)



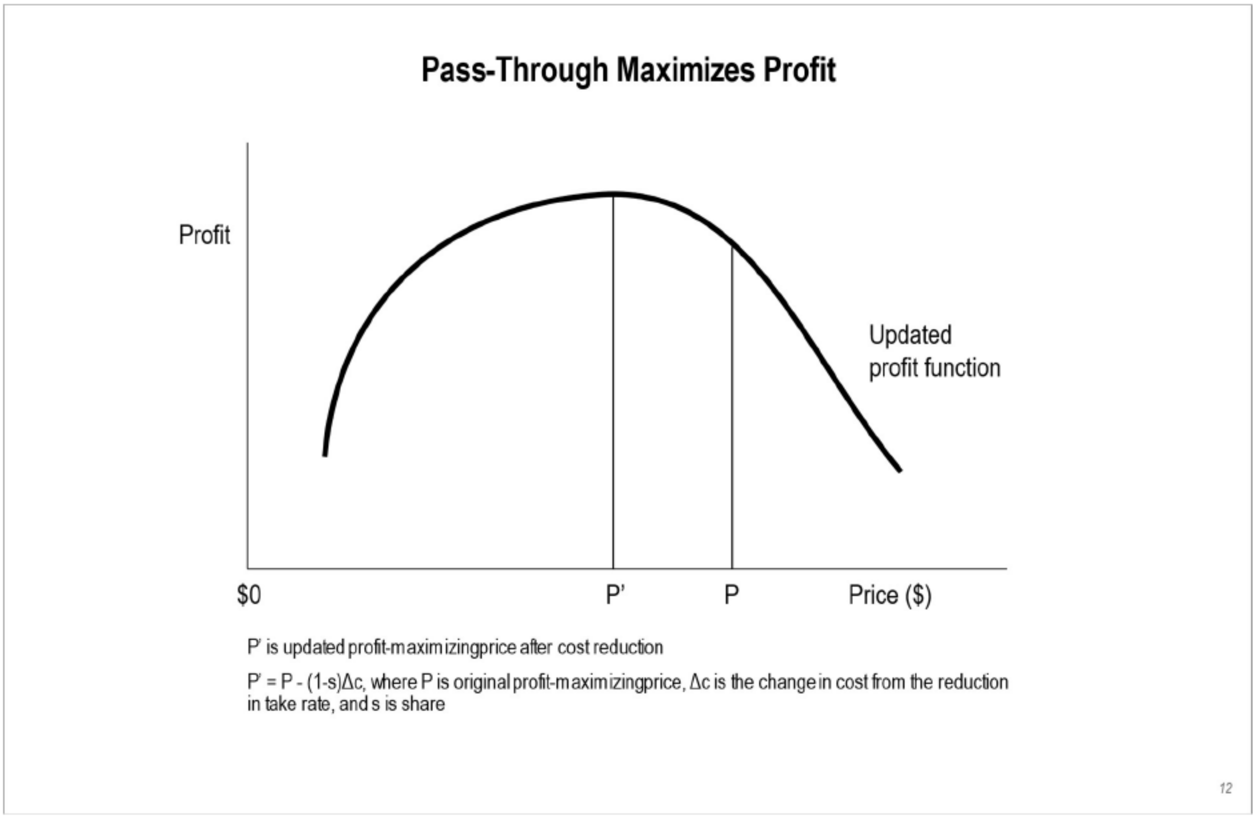
Source: Google Transaction Data. Note: Prices are also observed at one-cent intervals (not shown here).

This pattern of ten-cent (or smaller) pricing increments remains consistent until price points above $100 are reached.[952]

408. Furthermore, if focal-point pricing were widely used, my models can accommodate it. To illustrate, consider the example below. The firm begins with a profit-maximizing price (P) at the original costs. Suppose next that there is a change in the costs, such as a permanent reduction in take rates. The firm re-optimizes by choosing a new price (P') which maximizes the new profit function. The logit model tell us precisely by how much the firm alters its price: Start with the old price and then subtract the product of one minus the firm's share and the change in cost.

952. Google Transaction Data (GOOG-PLAY-007203251).

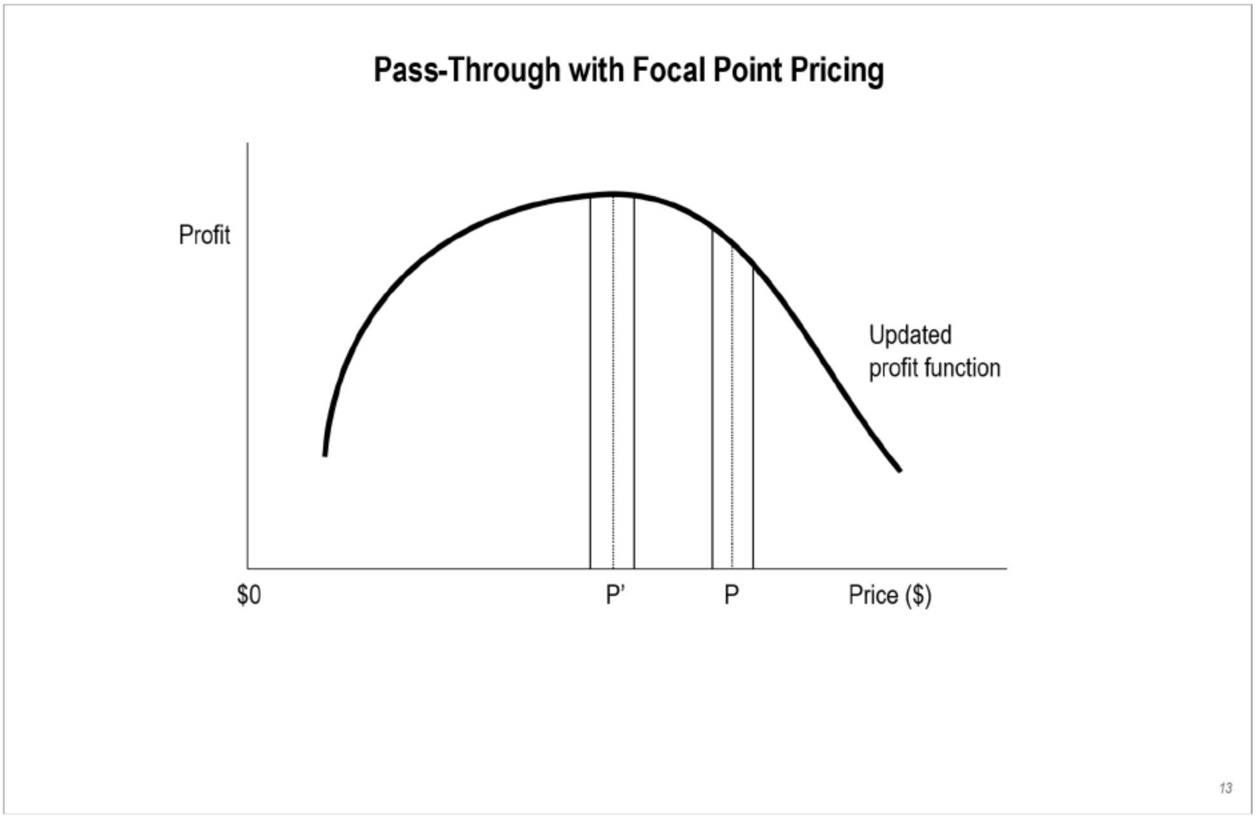
FIGURE 22: PASS-THROUGH WITHOUT FOCAL POINT PRICING



409. To take a simple numerical example, assume the price was initially $10, and that the take rate falls by 15 percentage points, yielding cost savings of $1.50. Suppose that the firm's share within the category is ten percent. This yields a but-for price of P' = $10 – (1-.1) x $1.50 = $8.65. This yields a savings for consumers of $10 - $8.65 = $1.35.

410. Now consider a firm that places some consideration on ending its price with a nine, perhaps based on a belief that consumers discount the last digits and "focus" on the first digits.

FIGURE 23: PASS-THROUGH WITH FOCAL POINT PRICING



411. As seen above, the firm is willing to deviate from the profit-maximizing price as predicted by economic theory to accommodate a taste for a price ending in a nine. It will deviate by the smallest step possible in either direction.

412. Consider another numerical example, this time beginning with an in-App price of $9.99. The change in marginal cost owing to a 15-percentage point decrease in the take rate is [$9.99 x 0.15] = $1.4985. The logit model predicts that the unconstrained new profit-maximizing pricing is P' = $9.99 – (1-.1) x $1.4985 = $8.64. To accommodate the developer's taste for ending in a nine, however, the developer chooses either $8.59 or $8.69. But the consumer is still better off by between $1.30 and $1.40.

413. In Table 17 below, I have implemented a comparable analysis for all Apps in Google's Transaction Data. As seen below, only 0.19 percent of transactions (representing just 0.006 percent of consumer expenditure) in the Play Store would not have seen a price decrease in the but-for world when the but-for price is constrained to end in "9."

TABLE 17:
AT MOST A *DE MINIMIS* SHARE OF APPS WOULD NOT LOWER PRICE
DUE TO FOCAL-POINT PRICING

	(1)	(2)
	% of all Units Sold	% of all Consumer Expenditures
App Distribution Market	[redacted]	[redacted]
In-App Aftermarket	[redacted]	[redacted]
Combined Markets	[redacted]	[redacted]

Source: Google Transaction Data. *Notes*: Focal-Point Pricing defined as price ending in "9", consistent with the economic literature. This analysis was performed using before-tax prices. Each app-month's but-for price was rounded to the nearest price with a hundredth decimal place ending in "9." This but-for focal-point price was then compared to the actual price charged. Column (1) displays the percentage of all units sold which would not have had a decreased App price in the but-for world. Column (2) displays this amount in terms of the sales revenues generated.

VII. AGGREGATE DAMAGES TO THE U.S. CONSUMERS

A. App/In-App Models

414. U.S. Consumers' aggregate damages are computed using the overcharges calculated in Tables 6 and 8. These damages are summarized in Table 18. In Appendix 5, I break down these damages by U.S. state and territory.

TABLE 18: AGGREGATE DAMAGES, APP/IN-APP MODELS (U.S., 8/16/2016 – 5/31/2022)

		Android App Distribution Market (Table 6)	**In-App Aftermarket (Table 8)**	**Aggregate**
[1]	**Average Actual Consumer Price**	[redacted]	[redacted]	[redacted]
[2]	**Average But-For Consumer Price**	[redacted]	[redacted]	[redacted]
[3] = [1]-[2]	**Average Overcharge**	[redacted]	[redacted]	[redacted]
[4]	**Quantity Purchased**	[redacted]	[redacted]	[redacted]
[5]	**Aggregate Damages**	[redacted]	[redacted]	[redacted]

Notes: Aggregate prices and overcharges are weighted averages across both markets.

415. In the event that proof of pass-through is not legally necessary, I have been asked to calculate aggregate damages based on the full reduction in the take rate in the but-for world. Under this assumption, aggregate damages for the Android App Distribution Market come to [redacted] and aggregate damages in the In-App Aftermarket come to [redacted]

B. Discount Model and Single Take Rate

416. Table 19 summarizes aggregate damages in the combined Android App Distribution Market and In-App Aftermarket under the modeling scenario where the locus of competition is on the consumer subsidy (as presented in Section VI.E and Table 16), and under the combined markets take rate competition model, where competition occurs only with respect to the take rate in a single, combined market (as presented in Appendix 4 and Table A4).

TABLE 19: AGGREGATE DAMAGES SUMMARY: DISCOUNT MODEL AND SINGLE TAKE RATE, (U.S., 8/16/2016 – 5/31/2022)

		Discount Model (Table 16)	Single Take Rate Model (Table A4)
[1]	**Average Actual Consumer Price**	[redacted]	[redacted]
[2]	**Average But-For Consumer Price**		
[3] = [1]-[2]	**Average Overcharge**		
[4]	**Quantity Purchased**		
[5]	**Aggregate Damages**		

In the event that proof of pass-through is not legally necessary, I have been asked to calculate aggregate damages based on the full reduction in the take rate in the but-for world. Under this assumption, aggregate damages for the Single Take Rate model come to $4.01 billion. Aggregate damages for the discount model, which does not depend on pass-through, would be the same.

C. Amazon Discount Damages

417. [redacted]

953. *See* Part VI.B.5.c above.

954. [redacted]

[redacted]

418. I understand that the legal standard for calculating damages allows for reasonable approximation. The Amazon Appstore's consumer discounts provide a reasonable benchmark for calculating aggregate damages. The Amazon Appstore, like the Play Store, participates in Android App Distribution Market. Like the Play Store, the Amazon Appstore is available on third-party smartphones and tablets that Amazon does not own. But unlike the Play Store, the Amazon Appstore is not dominant in the Android App Distribution Market, and is obliged to compete on the merits. Amazon has chosen to compete by offering generous consumer subsidies. [redacted][955] Moreover, in the absence of the Challenged Conduct, both Amazon and the Play Store would likely face additional competition from additional entrants, which could result in greater consumer discounts than those observed here.

419. Amazon's consumer discounts increase with user purchase volumes. For example, users can purchase Amazon Coins worth \$100 for \$82, for a discount of 18 percent, or Amazon Coins worth \$500 for \$400, for a discount of 20 percent; users can also purchase Amazon Coins worth \$3 for \$2.91, for a discount of three percent. Users can also earn Amazon Coins by purchasing eligible Apps and In-App Content through the Amazon Appstore. Amazon Coins do not expire, so even users who purchase small volumes on a monthly basis can receive discounts associated with high purchase volumes.[956] For purposes of calculating aggregate damages, the relevant statistic is the share of consumer expenditure that the Amazon Appstore pays out in consumer discounts in the aggregate on third-party devices (as opposed to the average per-customer discount). Accordingly, Amazon's aggregate discount of [redacted] percent on third-party devices is a reasonable benchmark for estimating aggregate damages.

420. Aggregate damages using the Amazon Appstore benchmark are calculated by multiplying aggregate consumer expenditure in the Play Store by the difference between (1) the Amazon Appstore's [redacted] percent consumer subsidy, and (2) the modest 1.61 percent consumer subsidy that the Play Store paid to consumers in the actual world. This calculation yields aggregate damages of [redacted] Table 21 also displays the damages resulting from my Discount Model; these damages are significantly lower [redacted] because the Discount Model conservatively assumes that the Play Store would enjoy a durable incumbency advantage in a more competitive

955. AMZ-GP_00002484, at 2488.
956. *See, e.g.,* https://www.amazon.com/coins.

but-for world—even when facing a rival such as Amazon or Facebook. Thus, Table 21 provides a range of aggregate damages flowing from foregone direct consumer discounts.

TABLE 21: DISCOUNT DAMAGES RANGE, U.S., 8/16/2016 – 5/31/2022

[1]	Actual Consumer Expenditure (Before Discounts)	[redacted]
[2]	Amazon Benchmark Consumer Subsidy	
[3]	Play Store Consumer Subsidy	
[4]=([2] - [3])*[1]	**Amazon Discount Damages**	
[5]	**Discount Damages (Table 16)**	

D. Aggregate Damages Extrapolated Through Mid-2023

421. Below I calculate aggregate damages through the expected trial date, extrapolating damages between May 31, 2022 and June 5, 2023. To perform the extrapolations, I first calculated the average daily damages during the time period from 8/16/2016 – 5/31/2022, and then assumed the same daily average for the time period from 6/1/2022 – 6/5/2023.

TABLE 22: EXTRAPOLATED AGGREGATE DAMAGES (U.S.)

Damages Model	Time Period		Total
	[redacted]		
Android App Distribution Market			[redacted]
In-App Aftermarket			
Discount Model			
Single Take Rate			
Hybrid Model			
Amazon Discount Model			

VIII. INDIVIDUAL U.S. CONSUMER-SPECIFIC DAMAGES

422. Below I present a formula for computing a given individual U.S. Consumer's damages based on the individual's purchase history.[957]

423. An individual consumer's damages are equal to the quantity purchased of each product multiplied by the difference between the actual and but-for price paid for her purchases in

957. For ease of exposition and presentation, here I present U.S. Consumer-Specific damages based on a U.S. Consumer's purchases within each of Google's 33 categories. However, the same framework could also be applied at the level of the developer. U.S. Consumer-specific damages would then be calculated based on an individual's expenditures at different developers, instead of different categories.

the Android App Distribution Market and the In-App Aftermarket. Mathematically, individual damages can be expressed as:

$$\text{Damages} = \sum_i OC\_AD_i \times Q\_AD_i + \sum_j OC\_AM_j \times Q\_AM_j$$

where OC_AD_i represents the overcharge in the Android App Distribution Market (for paid Apps)—that is, difference between the actual price and the but-for price. The term Q_AD_i represents the actual quantity purchased by a U.S. Consumer in the Android App Distribution Market. Similarly, OC_AM_j represents the overcharge in the In-App Aftermarket (for In-App Content), and Q_AM_j represents the actual quantity purchased by a U.S. Consumer in the In-App Aftermarket.[958]

424. The actual purchase quantities for each individual U.S. Consumer (Q_AD_i and Q_AM_j) are reported in Google's transactional data. The overcharges are calculated from the economic models reviewed above. Specifically, OC_AD_i is calculated using the two-sided market model presented in Section V.B, and OC_AM_j is calculated using the one-sided market model presented in Section V.C.

425. The overcharges depend on (1) how much the take rate falls in the competitive but-for world; and (2) the extent to which the lower take rate is passed on in the form of lower prices. With respect to (2), I have calculated pass-through rates for different developer categories in Section V.D above. A U.S. Consumer's damages will therefore depend on the category of Apps that the consumer purchased. All else equal, the higher the pass-through rate of the category purchased by a particular U.S. Consumer, the higher that U.S. Consumer's damages will be.

426. With respect to (1), the drop in the take rate will often be similar or identical across categories: Most categories have similar (or identical) take rates in the actual world, and would also have similar (or identical) take rates in the but-for world. Nevertheless, I allow for variation in the but-for take rate across categories as follows: Suppose that the overall take rate is 30 percent in the actual world, and that a given category has an actual take rate of 29 percent. Suppose further that the overall but-for take rate is 20 percent. The category's but-for take rate would be calculated as [20 percent] x [29 percent]/[30 percent] = 19.33 percent. More generally, a category's but-for take rate is permitted to deviate from the overall but-for take rate in the same proportion in which the category's actual take rate deviates from the average actual take rate.

427. To illustrate, suppose that a consumer spent $10 on Apps in the "Art and Design" category in the Android App Distribution Market, as illustrated in the first row of Table 23 below. The actual take rate for the "Art and Design" category is 26.4 percent, and the but-for take rate for that same category is 20.2 percent. The pass-through rate for "Art and Design" is 67 percent. Given these inputs, the U.S. Consumer's expenditures would fall to $9.52 in the but-for world. To see this, let P_b represent the consumer's but-for expenditures. Let t_a and t_b represent the actual and but-

958. The summation operator (∑) is used because a U.S. Consumer may have multiple transactions in the Android App Distribution Market and the In-App Aftermarket.

for take rates, and let γ be the pass-through rate. The difference between the U.S. Consumer's actual and but-for expenditures is [$\$10 - P_b$]. This difference satisfies the following equation:

$$[\$10 - P_b] = \gamma[\$10t_a - P_b t_b]$$

428. Solving for P_b, we obtain $P_b = \$10x([1- \gamma t_a]/[1 - \gamma t_b])$. Inserting the inputs from the "Art and Design" category, we have $P_b = \$10x([1- 0.67*0.264]/[1 - 0.67*0.202]) = \$9.52$.[959] Thus, a U.S. Consumer with $10 of expenditures in the "Art and Design" category of the Android App Distribution Market would have damages of $10 - $9.52 = $0.48. In other words, damages would equal 4.8 percent of expenditures (equal to $0.48/$10). Comparable calculations are performed for each remaining category in subsequent rows of Table 23.

959. More precisely, the actual take rate for the "Art and Design" category is 0.2645 with a pass-through equal to 0.69.

TABLE 23: ILLUSTRATIVE U.S. CONSUMER DAMAGES: ANDROID APP DISTRIBUTION MARKET

Category	CM Expenditure	Actual Take Rate	But-For Take Rate	Pass-Through Rate	But-For Expenditure	CM Damages	CM Overcharge (%)
ART_AND_DESIGN	$10.00	[redacted]	[redacted]	67%	[redacted]	[redacted]	[redacted]
AUTO_AND_VEHICLES	$10.00			82%			
BEAUTY	$10.00			44%			
BOOKS_AND_REFERENCE	$10.00			85%			
BUSINESS	$10.00			85%			
COMICS	$10.00			60%			
COMMUNICATION	$10.00			88%			
DATING	$10.00			81%			
EDUCATION	$10.00			92%			
ENTERTAINMENT	$10.00			85%			
EVENTS	$10.00			47%			
FINANCE	$10.00			74%			
FOOD_AND_DRINK	$10.00			81%			
GAME	$10.00			94%			
HEALTH_AND_FITNESS	$10.00			94%			
HOUSE_AND_HOME	$10.00			70%			
LIBRARIES_AND_DEMO	$10.00			59%			
LIFESTYLE	$10.00			66%			
MAPS_AND_NAVIGATION	$10.00			84%			
MEDICAL	$10.00			93%			
MUSIC_AND_AUDIO	$10.00			41%			
NEWS_AND_MAGAZINES	$10.00			88%			
PARENTING	$10.00			85%			
PERSONALIZATION	$10.00			87%			
PHOTOGRAPHY	$10.00			92%			
PRODUCTIVITY	$10.00			84%			
SHOPPING	$10.00			41%			
SOCIAL	$10.00			89%			
SPORTS	$10.00			80%			
TOOLS	$10.00			96%			
TRAVEL_AND_LOCAL	$10.00			88%			
VIDEO_PLAYERS	$10.00			86%			
WEATHER	$10.00			80%			

429. Table 24 below performs comparable calculations for the In-App Aftermarket. For example, suppose that a U.S. Consumer spent $10 on in-App purchases in the "Game" category. This category has an actual take rate of [redacted] a but-for take rate of [redacted] and a pass-through rate of [redacted] percent. Applying the prior formula, the U.S. Consumer's but-for expenditures

are [redacted] This yields damages of [redacted] for each $10 of U.S. Consumer expenditures in the "Game" category of the In-App Aftermarket. In other words, damages would be [redacted] of expenditures [redacted]

TABLE 24: ILLUSTRATIVE U.S. CONSUMER DAMAGES: IN- APP AFTERMARKET

Category	CM Expenditure	Actual Take Rate	But-For Take Rate	Pass-Through Rate	But-For Expenditure	CM Damages	CM Overcharge (%)
ART_AND_DESIGN	$10.00	[redacted]	[redacted]	67%	[redacted]	[redacted]	[redacted]
AUTO_AND_VEHICLES	$10.00			82%			
BEAUTY	$10.00			44%			
BOOKS_AND_REFERENCE	$10.00			85%			
BUSINESS	$10.00			85%			
COMICS	$10.00			60%			
COMMUNICATION	$10.00			88%			
DATING	$10.00			81%			
EDUCATION	$10.00			92%			
ENTERTAINMENT	$10.00			85%			
EVENTS	$10.00			47%			
FINANCE	$10.00			74%			
FOOD_AND_DRINK	$10.00			81%			
GAME	$10.00			94%			
HEALTH_AND_FITNESS	$10.00			94%			
HOUSE_AND_HOME	$10.00			70%			
LIBRARIES_AND_DEMO	$10.00			59%			
LIFESTYLE	$10.00			66%			
MAPS_AND_NAVIGATION	$10.00			84%			
MEDICAL	$10.00			93%			
MUSIC_AND_AUDIO	$10.00			41%			
NEWS_AND_MAGAZINES	$10.00			88%			
PARENTING	$10.00			85%			
PERSONALIZATION	$10.00			87%			
PHOTOGRAPHY	$10.00			92%			
PRODUCTIVITY	$10.00			84%			
SHOPPING	$10.00			41%			
SOCIAL	$10.00			89%			
SPORTS	$10.00			80%			
TOOLS	$10.00			96%			
TRAVEL_AND_LOCAL	$10.00			88%			
VIDEO_PLAYERS	$10.00			86%			
WEATHER	$10.00			80%			

960. More precisely, pass-through for the "Game" category is 0.9378.

CONCLUSION

430. For the foregoing reasons, I conclude that the Challenged was anticompetitive and resulted in injury to competition and consumers, including U.S. Consumers overpaying for initial downloads from the Play Store and for In-App Content. In addition, the proposed Injunctive Class would benefit from removal of the Challenged Conduct.

* * *

Hal J. Singer, Ph.D.:

Executed on October 3, 2022.

APPENDIX 1: CURRICULUM VITAE OF HAL J. SINGER

Hal J. Singer

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Ph.D., The John Hopkins University, 1999; M.A. 1996, Economics

B.S., Tulane University, *magna cum laude*, 1994, Economics. Dean's Honor Scholar (full academic scholarship). Senior Scholar Prize in Economics.

Current Positions

ECON ONE, Washington, D.C.: Managing Director 2018-present.

UNIVERSITY OF UTAH, Salt Lake City, UT: Adjunct Professor August 2022 - present.

Employment History

GEORGETOWN UNIVERSITY, MCDONOUGH SCHOOL OF BUSINESS, Washington, D.C.: Adjunct Professor 2010, 2014, 2016, 2018, 2019, 2020, 2021, 2022

ECONOMISTS INCORPORATED, Washington, D.C.: Principal 2014-2018.

NAVIGANT ECONOMICS, Washington, D.C.: Managing Director, 2010-2013.

EMPIRIS, L.L.C., Washington, D.C.: Managing Partner and President, 2008-2010.

CRITERION ECONOMICS, L.L.C., Washington, D.C.: President, 2004-2008. Senior Vice President, 1999-2004.

LECG, INC., Washington, D.C.: Senior Economist, 1998-1999.

U.S. SECURITIES AND EXCHANGE COMMISSION, OFFICE OF ECONOMIC ANALYSIS, Washington, D.C.: Staff Economist, 1997-1998.

THE JOHNS HOPKINS UNIVERSITY, ECONOMICS DEPARTMENT, Baltimore: Teaching Assistant, 1996-1998.

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American Bar Association Section of Antitrust Law

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DEPOSITIONS

Deposition of Paul Bankhead (May 11, 2022; May 12, 2022)

Deposition of Donn Morrill (Aug. 11, 2022)

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Deposition of Steven Allison (Jan. 26, 2022)

Deposition of Andrew Grant (Dec. 7, 2021)

Deposition of Rich Miner (September 8, 2022)

Deposition of Andy Rubin (May 17, 2022; May 18, 2022)

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Deposition of Jamie Rosenberg (July 14, 2020)

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Deposition of Purnima Kochikar (Aug. 31, 2022; Sept. 1, 2022)

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Deposition of Adrian Ong, Epic v. Apple (20-cv-05640-YGR)

Deposition of Sandra Alzetta (September 29, 2022)

Deposition of Sarah Karam (Sept. 28, 2022 – rough transcript)

APPENDIX 3: EXTENSIONS OF TWO-SIDED MARKET MODEL

431. In what follows, I derive the expressions used in Parts VI.B, VI.E, and Appendix 4 for demonstrating impact in the particular two-sided setting relevant to the instant case. This "applied" modeling is an extension of the "foundational" model in Rochet and Tirole (2003). I discuss three cases: (1) a case where competition occurs only with respect to the take rate t, (2) a case where competition occurs only with respect to the buyer-side price P_B, and (3) a case where competition occurs with respect to both the take rate t and the buyer-side price P_B.

432. In Rochet and Tirole 2003, the monopolist platform operator maximizes profit (denoted π^0) defined as:

(A.1) $$\pi^0 = (P_B + P_S - C)D_B(P_B)D_S(P_S)$$

where P_B and P_S are buyer- and seller-side platform prices, respectively; C is marginal transaction cost, and $D_B(P_B)$ and $D_S(P_S)$ are demand functions for buyers and sellers, respectively.[961] I extend the model (1) to accommodate Google charging a percentage take rate on the developer (seller) side, (2) to allow the average App or In-App Content (product) price (set by developers) to be a function of the take rate, and (3) to allow consumer (buyer) demand to be a function of the net App or In-App Content (product) price, defined as the sum of the product price and the platform price. The new profit function (denoted π) can be written as:

(A.2) $$\pi = (P_B + tS(t) - C)D_B(S(t) + P_B)D_S(t)$$

where $S(t)$ is the price of paid App downloads and t is the take rate or portion of consumer spend that is retained by Google.

433. Before continuing the exposition, it is useful to define the pass-through parameter γ which I refer to throughout:

(A.3) $$\gamma = \frac{\Delta SQ}{\Delta vQ} = \frac{\Delta S}{\Delta v}$$

where ΔS is the dollar change in product price to consumers and Δv is the dollar change in costs (including commissions paid to Google) to developers.

961. Rochet & Tirole at 996.

A. Case 1: Platform Operator Maximizes Profit Only With Respect to the Take Rate (Buyer-Side Platform Price Is Held Fixed)

434. In this subsection, I present the derivations used to arrive at Equations (V.3) and (V.5) in the report. If the platform operator maximizes profit with respect to the take rate, holding the buyer-side platform price fixed, the following first-order condition[962] follows from (A.2):

(A.4)
$$\frac{S + tS'}{P_B + tS - C} - \frac{\varepsilon_{B,t}}{t} - \frac{\varepsilon_{S,t}}{t} = 0$$

where S' is the change in the product price with respect to the take rate, and the "take-rate elasticities" are:

(A.5)
$$\varepsilon_{B,t} = -\frac{tS'D_B'}{D_B}$$

(A.6)
$$\varepsilon_{S,t} = -\frac{tD_S'}{D_S}$$

D_B' and D_S' are first derivatives of the buyer and seller demand functions. Re-arranging (A.4):

$$\frac{S + tS'}{P_B + tS - C} = \frac{\varepsilon_{B,t} + \varepsilon_{S,t}}{t}$$

Inverting each side:

$$\frac{P_B + tS - C}{S + tS'} = \frac{t}{\varepsilon_{B,t} + \varepsilon_{S,t}}$$

Dividing by t gives Equation (V.3):

(A.7), (V.3)
$$\frac{P_B + tS - C}{tS + t^2S'} = \frac{1}{\varepsilon_{B,t} + \varepsilon_{S,t}}$$

Let k be a developer's marginal cost. The per-unit cost to developers from the take rate is equal to $tS(t)$, implying that the change in marginal cost resulting from a change in the take rate is $\frac{\partial k}{\partial t} = S(t) + tS'(t)$. Setting $\Delta v = S(t) + tS'(t)$ and $\Delta S = S'(t)$ (the changes in price and cost, respectively, resulting from a change in the take rate) in expression (A.3) gives $\gamma = \frac{S'(t)}{S(t)+tS'(t)}$. Re-arranging gives the following expression for $S'(t)$:

962. A first-order condition describes the point at which profit maximization is achieved and is a commonly used tool in economic modeling. *See, e.g.,* JEFFREY M. PERLOFF, MICROECONOMICS A-34 (Pearson 7th ed. 2015). As in Rochet and Tirole, I apply the log-transform to the profit function, then take the derivative with respect to t.

(A.8)
$$S'(t) = \frac{\gamma}{1 - t\gamma} S(t)$$

435. In a monopoly setting, elasticities reflect that the platform operator faces no competition. In a competitive setting, profit is maximized with respect to "residual" demand, defined as the demand curve faced by the platform operator in the presence of competition.[963] To determine the competitive equilibrium condition, I replace demand functions $D_B(S(t) + P_B)$ and $D_S(t)$ in expression (A.2) with residual demand functions and repeat steps (A.4) through (A.7). Residual demand functions are formally defined as the difference between market demand and the quantity being supplied by the firm's rivals:

(A.9)
$$RD_B(S(t) + P_B) = D_B(S(t) + P_B) - Q_{R,B}(S(t) + P_B)$$

(A.10)
$$RD_S(t) = D_S(t) - Q_{R,S}(t)$$

where $Q_{R,B}(S(t) + P_B)$ and $Q_{R,S}(t)$ represent the amount of product supplied by the platform's rivals at price $S(t) + P_B$ and take rate t.[964] Steps (A.4) through (A.7) using the residual demand curves then give the analogous competitive expression used in Equation (V.5):

(A.11), (V.5)
$$\frac{P_B + tS - C}{tS + t^2 S'} = \frac{1}{\varepsilon_{OB,t} + \varepsilon_{OS,t}}$$

where $\varepsilon_{OB,t}$ and $\varepsilon_{OS,t}$ are "own-brand" elasticities on the buyer (consumer) and seller (developer) sides, respectively, reflecting the change in quantity demanded from consumers for transaction on the firm's (Google's) platform in response to a change in the take rate and in the presence of competition.

436. To solve for the product price in the competitive setting, I use the pass-through equation (A.3), and note that the change in the total commissions (from $t^M S^M$ to $t^C S^C$) from a change in the take rate satisfies:

(A.12)
$$\gamma = \frac{\Delta S}{\Delta v} = \frac{S^M - S^C}{t^M S^M - t^C S^C}$$

963. *See, e.g.*, Landes & Posner at 985.
964. *Id.*

where superscripts ^{M} and ^{C} denote the monopoly and competitive cases, respectively. Re-arranging allows expression of the product price in the competitive world in terms of the competitive take rate and monopoly inputs:

(A.13), (V.8)
$$S^C = S^M \frac{1-\gamma t^M}{1-\gamma t^C}$$

Using this expression, I can then solve for the competitive take rate that satisfies (A.10), having estimated the other inputs (S^M, C, and competitive elasticities).

B. Case 2: Platform Operator Maximizes Profit Only With Respect to the Buyer-Side Platform Price (Take Rate Is Held Fixed)

437. Using the same objective function (A.2) but maximizing profit with respect to the buyer-side platform price yields the following first-order condition, now taken with respect to P_B:

(A.14)
$$\frac{1}{P_B + tS(t) - C} - \frac{\varepsilon_B}{(S+P_B)} = 0$$

where ε_B is the price elasticity of demand for App products (taken with respect to the net price $S + P_B$):

(A.15)
$$\varepsilon_B = -\frac{(S+P_B){D_B}'}{D_B}$$

Re-arranging (A.13) gives Equation (V.11):

(A.16), (V.11)
$$\frac{P_B + tS - C}{S + P_B} = \frac{1}{\varepsilon_B}$$

438. To solve for the competitive equilibrium condition, I replace demand functions $D_B(S(t) + P_B)$ and $D_S(t)$ with residual demand functions (defined in Equations A.9 and A.10) in expression (A.2) and repeat steps (A.14) through (A.16). This gives the competitive expression used in Equation (V.12):

(A.17), (V.12)
$$\frac{P_B + tS - C}{S + P_B} = \frac{1}{\varepsilon_{OB}}$$

Note that the product price elasticity of demand is related to the *take rate* elasticity of demand (given by Equation (A.5)):

$$\varepsilon_B = -\frac{tS'D_B'}{D_B} * \frac{(S+P_B)}{S'}$$

or

(A.18)
$$\varepsilon_B = \varepsilon_{B,t} \frac{(S+P_B)}{tS'}$$

The analogous expression using own-brand elasticities is:

(A.19)
$$\varepsilon_{OB} = \varepsilon_{OB,t} \frac{(S + P_B)}{tS'}$$

The developer-side take rate elasticity of demand is also related to the developer-side price elasticity of demand, where the developer-side price is equal to the take rate multiplied by the product price. Define the developer price as $H = tS(t)$ and developer side demand as a function of price as $Q(H)$. Define developer-side price elasticity of demand as:

(A.20)
$$\varepsilon_S = -\frac{HQ'(H)}{Q(H)} = -\frac{tS(t)Q'\big(tS(t)\big)}{Q\big(tS(t)\big)}$$

Noting that $Q\big(tS(t)\big) = D(t)$, Equation (A.6) implies that

(A.21)
$$\varepsilon_{S,t} = -\frac{tQ'\big(tS(t)\big)\big(S(t) + tS'(t)\big)}{Q\big(tS(t)\big)}$$

Using Equation (A.8) then implies:

$$\varepsilon_{S,t} = -\frac{tS(t)Q'\big(tS(t)\big)\left(1 + \frac{t\gamma}{1 - t\gamma}\right)}{Q\big(tS(t)\big)}$$

which simplifies to:

(A.22)
$$\varepsilon_{S,t} = \varepsilon_S \left(\frac{1}{1 - t\gamma}\right)$$

The analogous expression using own-brand elasticities is:

(A.23)
$$\varepsilon_{OS,t} = \varepsilon_{OS} \left(\frac{1}{1 - t\gamma}\right)$$

C. Case 3: Platform Operator Maximizes Profit Simultaneously With Respect to Both the Buyer-Side Platform Price and the Take Rate

439. In this model, a monopolist platform operator maximizes its profits by setting the take rate t and the buyer-side platform price P_B such that both first order conditions (A.4) and (A.14) are satisfied, or equivalently, the following two conditions are satisfied:

(A.7), (V.3)
$$\frac{P_B + tS - C}{tS + t^2 S'} = \frac{1}{\varepsilon_{B,t} + \varepsilon_{S,t}}$$

(A.16), (V.11)
$$\frac{P_B + tS - C}{S + P_B} = \frac{1}{\varepsilon_B}$$

where S is the product price, C is marginal platform transaction cost, γ is the pass-through rate, $\varepsilon_{B,t} + \varepsilon_{S,t}$ is the sum of buyer and seller-side take rate elasticities of demand, and ε_B is the buyer-side product price elasticity of demand. In the competitive setting, the analogous two conditions are satisfied:

(A.11), (V.5)
$$\frac{P_B + tS - C}{tS + t^2 S'} = \frac{1}{\varepsilon_{OB,t} + \varepsilon_{OS,t}}$$

(A.17), (V.12)
$$\frac{P_B + tS - C}{S + P_B} = \frac{1}{\varepsilon_{OB}}$$

where $\varepsilon_{OB,t} + \varepsilon_{OS,t}$ is the sum of own-brand buyer and own-brand seller-side take rate elasticities of demand, and ε_{OB} is own-brand buyer-side product price elasticity of demand. Given the inputs $C, \gamma, \varepsilon_{OB}, \varepsilon_{OB,t}, \varepsilon_{OS,t}$, which I estimate, leaves two unknowns: t, P_B, which I can then determine using the two equations.

APPENDIX 4: RESULTS OF SINGLE MARKET TAKE RATE MODEL AND SINGLE-MARKET HYBRID MODEL

440. In Part VI.B above I present a model in which the locus of platform competition in the Android App Distribution Market was the take rate. That is, absent Google's anticompetitive restrictions, I model the extent to which Google would lower its take rate in response to competition. In this model, I hold the buyer-side subsidy fixed at its observed proportion to the paid App download price. In Part VI.E, I presented an alternative model in which Google increases its loyalty points program for consumers to encourage their use of the Play Store and Google Play Billing rather than using a competing source of Apps or In-App Content. In this buyer-side platform competition model, I model competition with respect to a single per-unit consumer subsidy across both initial paid App downloads and purchases of In-App Content, as Google's present (though small in magnitude) loyalty points program uses this structure (rather than having two different points programs). In this model, I hold the take rate fixed at its observed monopoly level.

441. Here I present two more scenarios (the "single market take rate model" and "single-market hybrid model"). In the single-market take rate model, competition occurs only with respect to a take rate (holding the buyer-side subsidy fixed). In the single-market hybrid model, competition occurs with respect to both the take rate and buyer-side subsidy. Both models apply to a single combined market which includes both the Android App Distribution Market and the In-App Aftermarket. The single market take rate model follows the same steps as the Android App Distribution Market take rate model presented in Part VI.B; however, in the single market take rate model presented here, the platform operator maximizes profit by choosing a take rate that applies to all transactions (both initial downloads and in-App purchases). Because of this distinction, input values differ across models. In the single market hybrid model, the platform operator maximizes profit by simultaneously choosing a take rate and buyer subsidy that applies to all transactions (both paid initial downloads and In-App purchases).

442. For these two scenarios, my sources and methods for obtaining the monopoly inputs shown in Equation (V.3) are:

- P_B^M is equal to the (negative) price charged by Google to consumers for transactions made on its platform in the monopoly scenario. I compute the average value of this price as the sum of all promotions paid by Google for transactions made in both the Android App Distribution Market and In-App Aftermarket, divided by the total quantity of paid Apps downloaded in the Android App Distribution Market and purchases of In-App Content in the In-App Aftermarket, as observed in Google's transaction records.

- t^M is equal to the observed take rate, computed as the sum of all revenue retained by Google in the Android App Distribution Market and In-App Aftermarket divided by the sum of total revenue spent by consumers in the Android App Distribution Market and In-App Aftermarket (prior to Google's promotional expenditures, which are captured by P_B^M).

- S^M is equal to the average price charged for paid Apps in the Android App Distribution Market and In-App Content in the In-App Aftermarket in the monopoly setting, calculated as the total amount of revenue spent by consumers (prior to receiving promotions from Google) in the Android App Distribution Market and In-App Aftermarket divided by the

total quantity of paid Apps downloaded in the Android App Distribution Market and purchases of In-App Content in the In-App Aftermarket, as observed in Google's transaction records.

- Marginal cost C represents the incremental cost incurred by Google in executing a transaction. I refer to Google's financial data to infer this value, which suggests that transaction fees and direct costs that Google records for the Play Store (excluding content costs) are approximately [redacted] percent of consumer expenditures.[965]

- γ is equal to the change in the App price S charged to consumers with respect to a change in developers' costs (including the cost imposed on developers through Google's take rate), also known as the pass-through rate. This parameter is discussed in detail in Section V.D, where I estimate its value at 91.1 percent.

- S'^M represents the change in the product price resulting from a small change in the take rate. I solve for S'^M in terms of the take rate and pass-through rate: $S'^M = \frac{\gamma}{(1-t^M\gamma)} S^M$. Appendix 3 contains a derivation of this expression (Equation (A.8)).

- ε_B^M is the buyer-side product price elasticity of demand for transactions in the Android App Distribution Market and In-App Aftermarket. Given the other inputs to the monopoly model, the value of ε_B^M is implied by Equation (V.11).

- ε_S^M is the seller-side product price elasticity of demand for transactions in the Android App Distribution Market and In-App Aftermarket. Given the other inputs to the monopoly model, the value of ε_S^M is implied by Equation (A.22).

- $\varepsilon_{B,t}^M$ and $\varepsilon_{S,t}^M$ are the take-rate elasticities of demand for transactions in the Android App Distribution Market and In-App Aftermarket from consumers and developers, respectively, in the presence of Google's monopoly. Given the other inputs to the monopoly model, the value of the sum $\varepsilon_{B,t}^M + \varepsilon_{S,t}^M$ is implied by Equation (V.3).

443. I hold inputs C and γ fixed between the monopoly and competitive scenarios. My sources and methods for obtaining the remaining inputs to the competitive scenario expression shown in Equation (V.5) are:

- t^C is equal to the but-for (competitive) take rate. I solve for the but-for take rate by finding the value that satisfies Equation (V.5) given the remaining inputs.

- S^C is the price of paid App downloads and In-App Content that developers would charge in a competitive scenario. S^C can be calculated in terms of other inputs (S^M, t^M, t^C, γ) according to Equation (V.8).

965. *See* work papers for this report.

- S'^C represents the change in the product price resulting from a small change in the take rate in the competitive setting. I solve for S'^C in terms of the take rate and pass-through rate: $S'^C = \frac{\gamma}{(1-t^C\gamma)} S^C$. Appendix 3 contains a derivation of this expression.

- ε^C_{OS} is the seller-side product price elasticity of demand for transactions in the Android App Distribution Market and In-App Aftermarket. Given the other inputs to the monopoly model, the value of ε^C_{OS} is implied by Equation (A.23).

- $\varepsilon^C_{OB,t}$ and $\varepsilon^C_{OS,t}$ are the "own-brand" take-rate elasticities of demand for transactions in the Android App Distribution Market and In-App Aftermarket for consumers and developers, respectively, in the presence of competition.

- P^C_B is equal to the (negative) price charged by Google to consumers for transactions made in the Android App Distribution Market and In-App Aftermarket in the competitive scenario. I hold the buyer-side platform price fixed in proportion to the product price: $P^C_B = \left(\frac{P^M_B}{S^M}\right) S^C$.

444. Table A4 shows the results of the single market take rate model. At a pass-through rate of $\gamma = 91.1$ percent, the resulting but-for average price is [redacted] down from the observed price of [redacted] (net of Google's promotional expenditures to consumers). This difference results in aggregate damages of [redacted] for the U.S. for the period 8/12/2016 – 5/31/2022. Following the same steps taken in Section VI.B.3, I estimate that Google's take rate elasticities shift from [redacted] (in the monopoly setting, as calculated using Equation (V.3)) to [redacted] in the competitive setting. Because this model is applied to both paid initial downloads and In-App purchases, the elasticity values vary slightly from those shown in Table 6 (which reflect paid initial downloads only)

TABLE A4: SINGLE TAKE RATE MODEL, IMPACT AND DAMAGES,
(U.S., 8/16/2016 – 5/31/2022)

Actual World (Monopoly, Eqn. (3))

#	Input	Description	Value	Source/Notes
[1]		Consumer Expenditure (US; Before Discounts)	[redacted]	GOOG-PLAY 005535886; Google Transaction Data (US Consumers)
[2]		Google Revenue (US; Before Discounts)		*Id.*
[3]		Google Promotional Expenditures (US)		*Id.*
[4]		Android App Distribution (Paid) and In-App Aftermarket Transactions (US)		*Id.*
[5]=[1]/[4]	S^M	App Product Price		Calculated
[6]=[2]/[1]	t^M	Take Rate		Calculated
[7]=-[3]/[4]	P_B	Buyer-side Platform Price		Calculated
[8]=[5]+[7]	$S^M + P_B$	App Product Price Net of Discounts		Calculated
[9]	C	Marginal Cost		GOOG-PLAY-000416245; GOOG-PLAY-010801682
[10]	γ	Pass-through Rate		Estimated (See Table 13)
[11]	$\varepsilon^M_{B,t} + \varepsilon^M_{S,t}$	Take Rate Elasticities of Demand		Calculated (Eqn. (V.3))

But-For World (Competitive, Eqn. (4))

	Input			Source
[12]	S^C	App Product Price		Calculated (Eqn. (V.8))
[13]	t^C	Take Rate		Calculated (Eqn. (V.5))
[14]=([7]/[5])*[12]	P_B	Buyer-side Platform Price		Calculated
[15]=[12]+[14]	$S^C + P_B$	App Product Price Net of Discounts		Calculated
[16]=[9]	C	Marginal Cost		GOOG-PLAY-000416245; GOOG-PLAY-010801682
[17]=[10]	γ	Pass-through Rate		Estimated (See Table 13)
[18]	$\varepsilon^C_{OB,t} + \varepsilon^C_{OS,t}$	Take Rate Elasticities of Demand		Economic theory/empirical studies
[19]=[8]-[15]		Consumer Savings Per Transaction		Calculated
[20]=[19]*[4]		**Aggregate Damages**		Calculated

Notes: See notes for Table 6, *supra*.

445. Table A5 shows the results of the hybrid version of the Single Take Rate model, which solves simultaneously for equilibrium prices on both sides of the market. The consumer subsidy would increase to [redacted] per transaction, up from [redacted] per transaction in the actual world. The but-for take rate is [redacted] down from [redacted] in the actual world. The combined effect of a higher buyer-side subsidy and a lower take rate yields aggregate damages to the Class of [redacted]

TABLE A5: SINGLE MARKET HYBRID MODEL, (U.S., 8/16/2016 – 5/31/2022) [966]

#	Input	Description	Value	Source/Notes
Actual World (Monopoly, Eqns. (V.3, V.11))				
[1]		Consumer Expenditure (US; Before Discounts)	[redacted]	GOOG-PLAY 005535886; Google Transaction Data (US Consumers)
[2]		Google Revenue (US; Before Discounts)		*Id.*
[3]		Google Promotional Expenditures (US)		*Id.*
[4]		Android App Distribution (Paid) and In-App Aftermarket Transactions (US)		*Id.*
[5]=[1]/[4]	S^M	App Product Price		Calculated
[6]=[2]/[1]	t^M	Take Rate		Calculated
[7]=-[3]/[4]	P_B	Buyer-side Platform Price		Calculated
[8]=[5]+[7]	$S^M + P_B$	App Product Price Net of Discounts		Calculated
[9]	C	Marginal Cost		GOOG-PLAY-000416245; GOOG-PLAY-010801682
[10]	γ	Pass-through Rate		Estimated (See Table 13)
[11]	$\varepsilon^M{}_B$	Consumer-side Product Price Elasticity of Demand		Calculated (Eqn. (V.11))
[12]	$\varepsilon^M{}_{B,t}$	Consumer-side Take Rate Elasticity of Demand		Calculated (Eqn. (A.18))
[13]	$\varepsilon^M{}_S$	Developer-side Price Elasticity of Demand		Calculated (Eqn. (A.22))
[14]	$\varepsilon^M{}_{S,t}$	Developer-side Take Rate Elasticity of Demand		Calculated (Eqn. (V.3))
[15]	$\varepsilon^M{}_{B,t} + \varepsilon^M{}_{S,t}$	Take Rate Elasticities of Demand		Calculated (Eqn. (V.3))
But-For World (Competitive, Eqns. (V.5), (V.12))				
	Input			**Source**
[16]	S^C	App Product Price		Calculated (Eqn. (V.8))
[17]	t^C	Take Rate		Calculated (Eqn. (V.5))
[18]=([7]/[5])*[16]	P_B	Buyer-side Platform Price		Calculated
[19]=[16]+[18]	$S^C + P_B$	App Product Price Net of Discounts		Calculated
[20]=[9]	C	Marginal Cost		GOOG-PLAY-000416245; GOOG-PLAY-010801682
[21]=[10]	γ	Pass-through Rate		Estimated (See Table 13)
[22]	$\varepsilon^C{}_{OB}$	Consumer-side Product Price Elasticity of Demand		Economic theory/empirical studies
[23]	$\varepsilon^C{}_{OB,t}$	Consumer-side Take Rate Elasticity of Demand		Calculated (Eqns. (A.19), (A.8))
[24]	$\varepsilon^C{}_{OS}$	Developer-side Price Elasticity of Demand		Economic theory/empirical studies
[25]	$\varepsilon^C{}_{OS,t}$	Developer-side Take Rate Elasticity of Demand		Calculated (Eqn. A.23)

966. For sources and notes, *see* notes to Table 6, *supra*.

[26]=[23]+[25]	$\varepsilon^{C}_{OB,t} + \varepsilon^{C}_{OS,t}$	Take Rate Elasticities of Demand	[redacted]	Calculated
[27]=**[8]**-**[19]**		Consumer Savings Per Transaction	[redacted]	Calculated
[28]=**[27]***[4]**		**Aggregate Damages**	[redacted]	Calculated

[redacted]

[redacted]

APPENDIX 6: LOGIT DEMAND CURVE ESTIMATES (GAME SUBCATEGORIES)

App Category	(1) OLS Price Coefficient	(2) IV Price Coefficient
Action	[redacted]	
Adventure		
Arcade		
Board		
Card		
Casino		
Casual		
Educational		
Music		
Puzzle		
Racing		
Role Playing		
Simulation		
Sports		
Strategy		
Trivia		
Word		
Includes FE?		
Number of FE		
Observations		
R-Squared		

Notes: *p*-values in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Each column reports the logit price coefficient corresponding to a given Play store subcategory. Coefficient estimates calculated using a single, fully-interacted regression model allowing coefficients to vary across the 17 Play Store subcategories. I have excluded the "Family" game subcategory, which is comprised of [redacted] Fixed effects

are unique to App name, App subproduct, purchase type (App sale, In-App purchase, subscription), customer state, App category, and year.

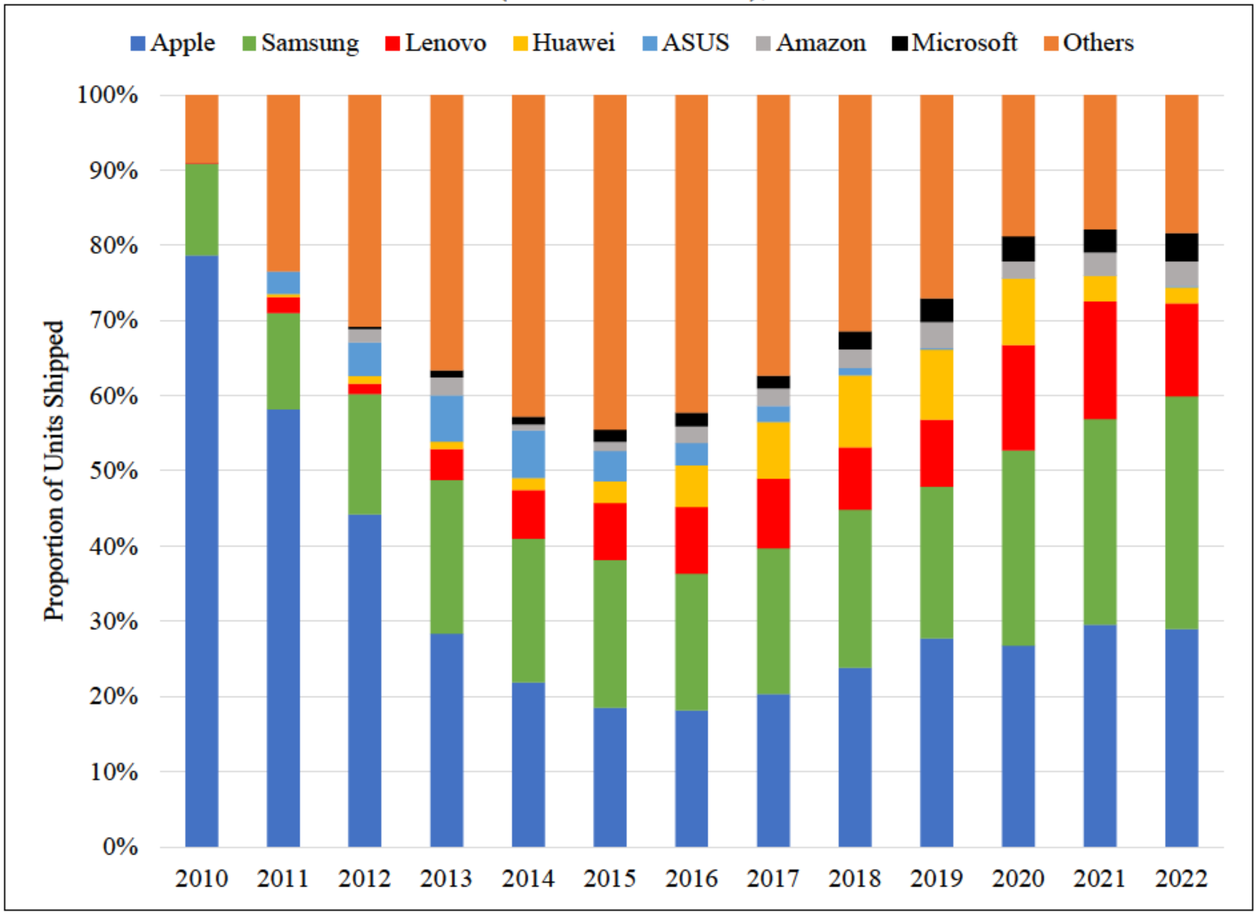
APPENDIX 7: PASS-THROUGH RATES (GAME SUBCATEGORIES)

App Category	Pass-Through Rate
ALL GAMES	**79.1%**
ACTION	81.4%
ADVENTURE	70.7%
ARCADE	87.2%
BOARD	80.5%
CARD	88.6%
CASINO	91.8%
CASUAL	57.4%
EDUCATIONAL	52.3%
MUSIC	68.6%
PUZZLE	89.5%
RACING	83.7%
ROLE PLAYING	95.5%
SIMULATION	93.7%
SPORTS	77.8%
STRATEGY	86.5%
TRIVIA	60.5%
WORD	81.4%

Notes: I have excluded the "Family" game subcategory, which is comprised of only 3 app titles with a total consumer spend of less than [redacted]

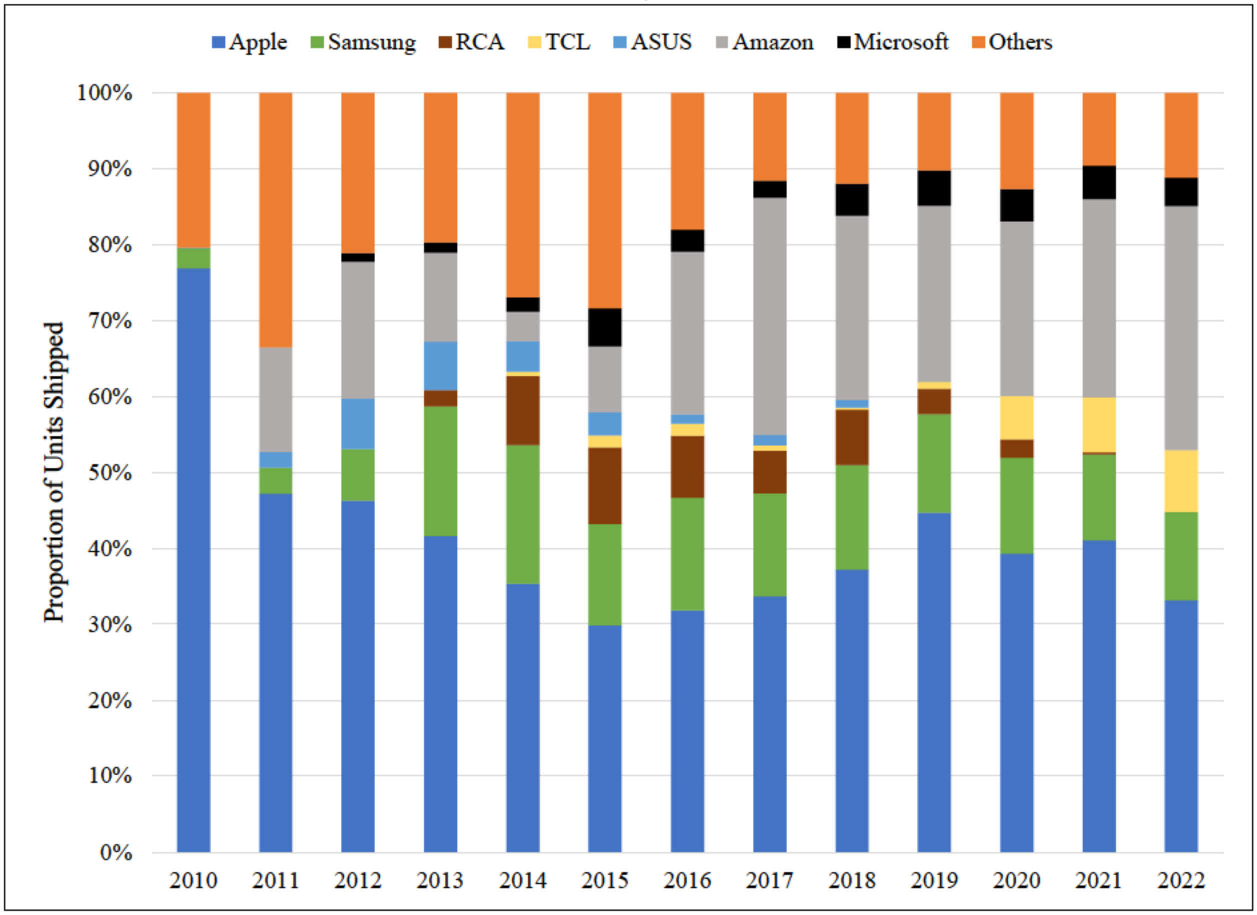
APPENDIX 8: MARKET SHARE STATISTICS FOR TABLETS

FIGURE A8-1: OEM SHARE OF TABLET UNIT SHIPMENTS WORLDWIDE (EXCLUDING CHINA), 2010 – 2022



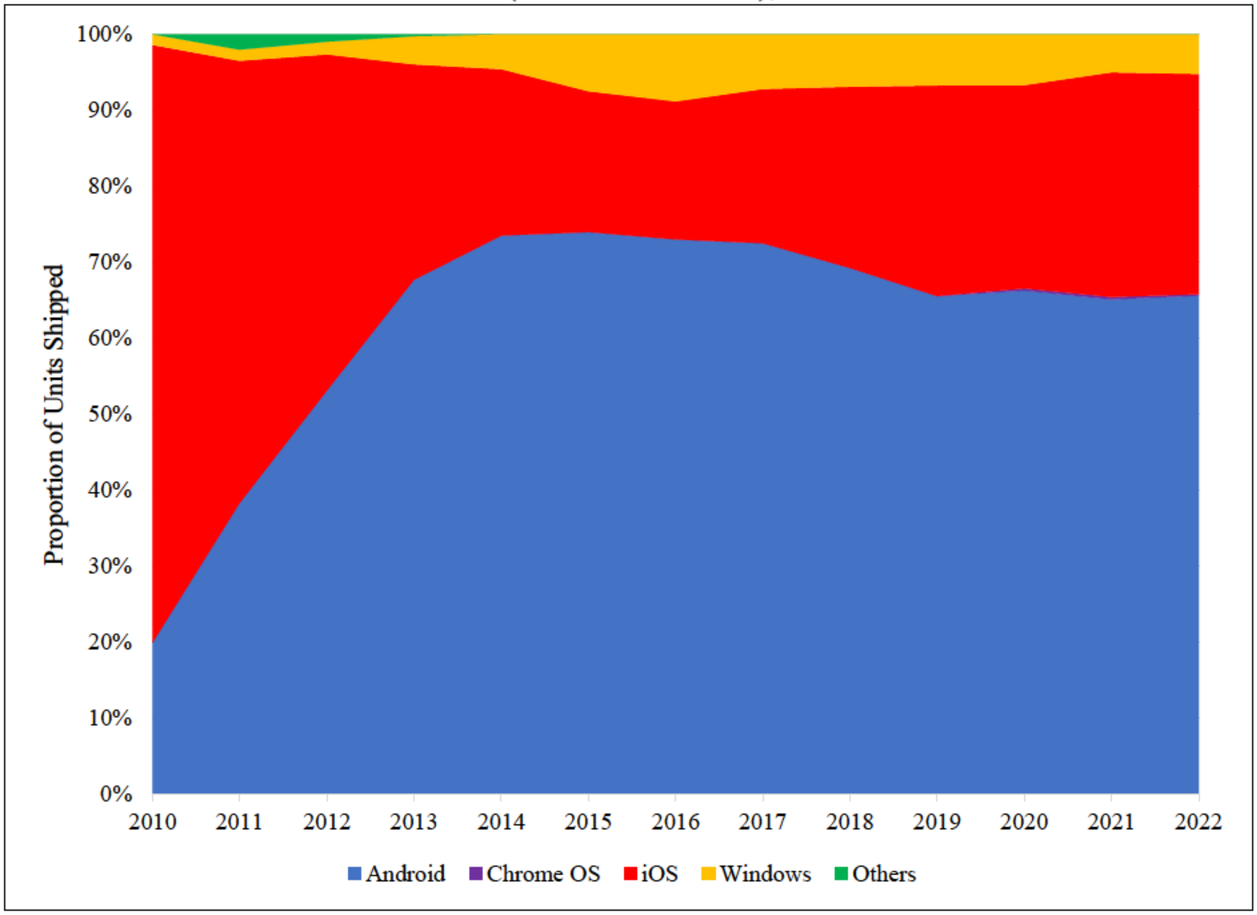
Source: IDC Worldwide Quarterly Personal Computing Device Tracker.

FIGURE A8-2: OEM SHARE OF TABLET UNIT SHIPMENTS
UNITED STATES, 2010 – 2022



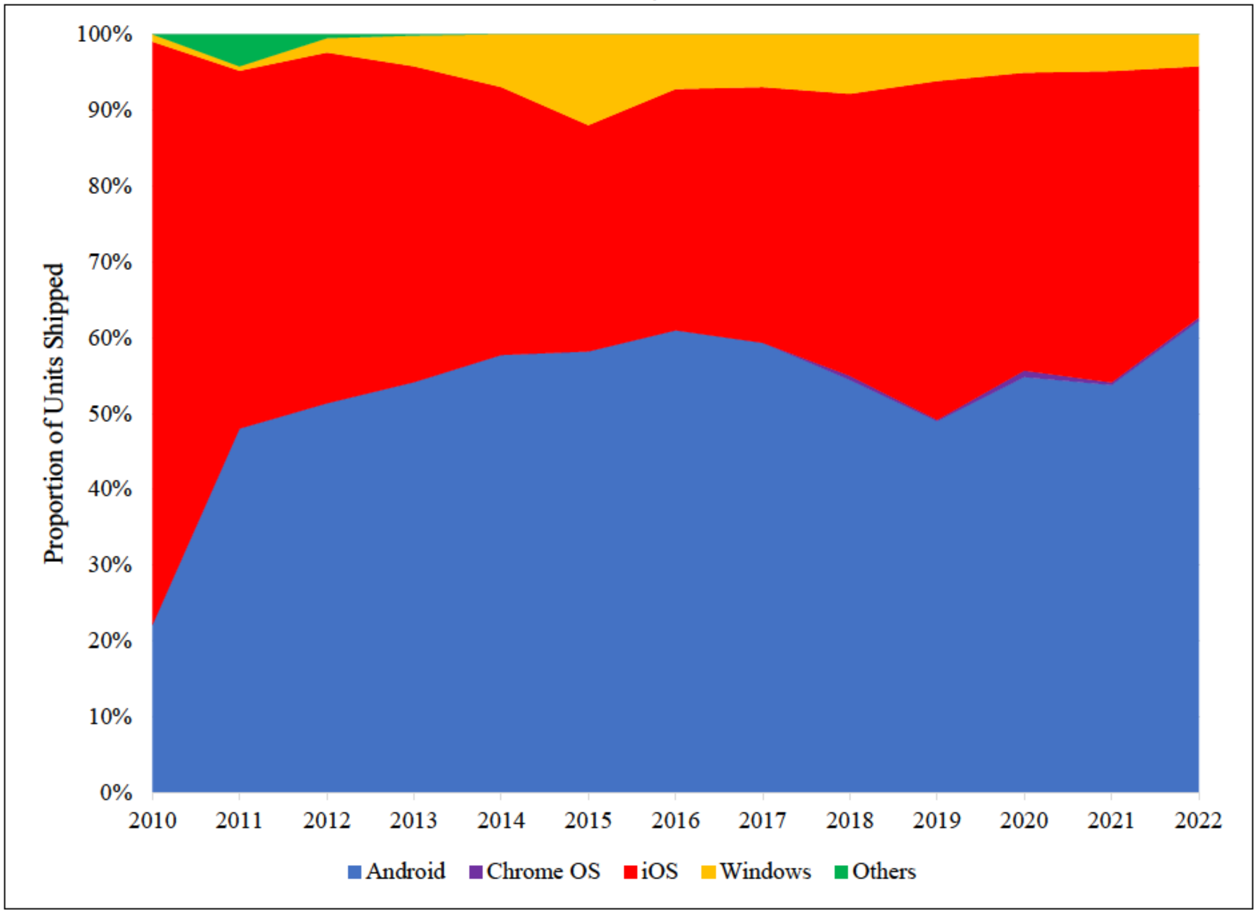
Source: IDC Worldwide Quarterly Personal Computing Device Tracker.

FIGURE A8-3: TABLET OS SHARE OF TABLET UNIT SHIPMENTS WORLDWIDE (EXCLUDING CHINA), 2010-2022



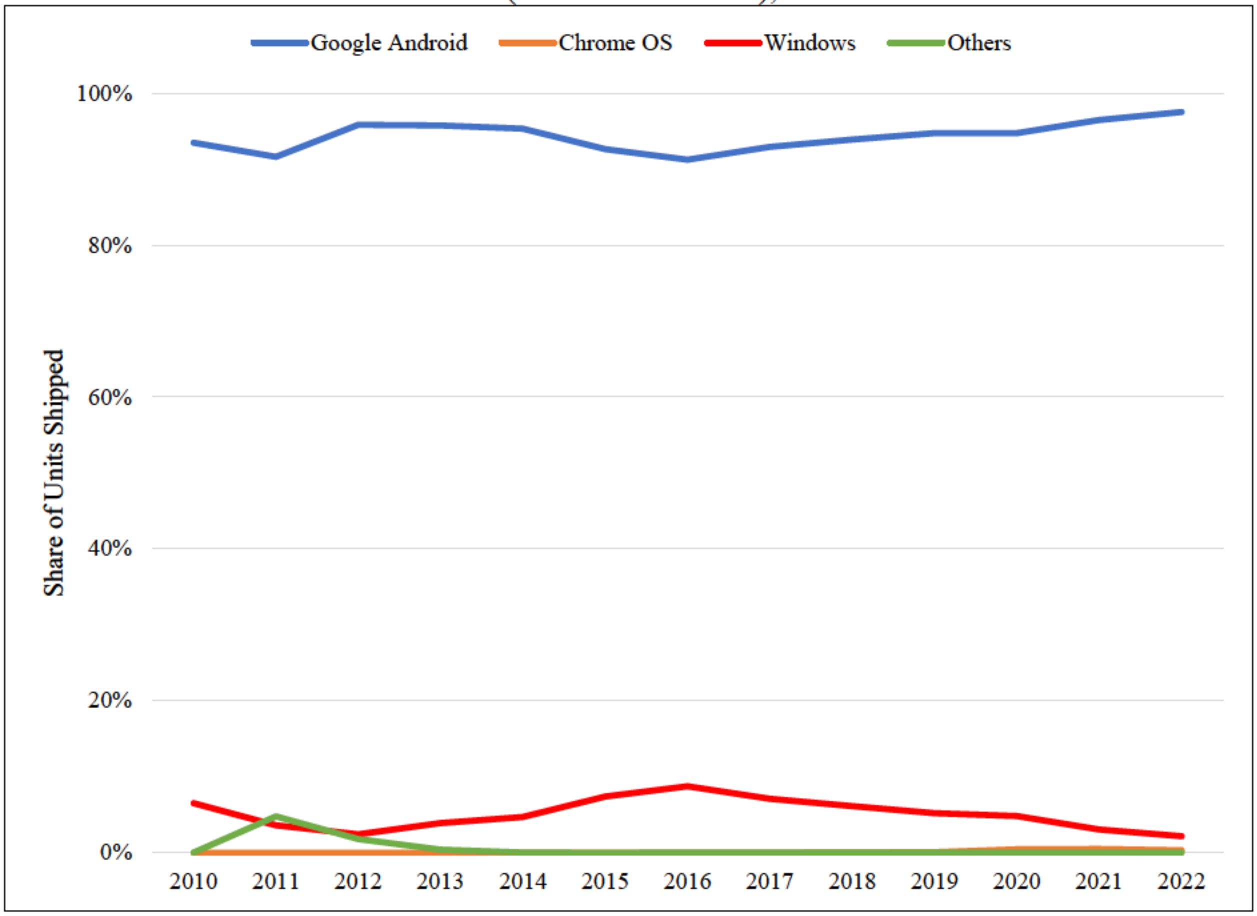
Source: IDC Worldwide Quarterly Personal Computing Device Tracker. Windows includes Windows RT.

FIGURE A8-4: TABLET OS SHARE OF TABLET UNIT SHIPMENTS
UNITED STATES, 2010-2022



Source: IDC Worldwide Quarterly Personal Computing Device Tracker. Windows includes Windows RT.

FIGURE A8-5: LICENSED TABLET OS SHARE OF TABLET UNITS SHIPPED WORLDWIDE (EXCLUDING CHINA), 2010-2022



Source: IDC Worldwide Quarterly Personal Computing Device Tracker. Windows includes Windows RT.

APPENDIX 9: AVAILABILITY OF TOP 100 PLAY STORE APPS IN APPLE APP STORE

Rank	App Name	In Apple App Store?
1	Candy Crush Saga	Yes
2	Clash of Clans	Yes
3	Pokémon GO	Yes
4	Coin Master	Yes
5	Pandora - Streaming Music, Radio & Podcasts	Yes
6	Candy Crush Soda Saga	Yes
7	Slotomania™ Free Slots: Casino Slot Machine Games	Yes
8	Game of War - Fire Age	Yes
9	HBO Max: Stream and Watch TV, Movies, and More	Yes
10	Roblox	Yes
11	Gardenscapes	Yes
12	Bingo Blitz™ - Bingo Games	Yes
13	Homescapes	Yes
14	Tinder - Dating, Make Friends and Meet New People	Yes
15	Jackpot Party Casino Games: Spin Free Casino Slots	Yes
16	Lords Mobile: Kingdom Wars	Yes
17	Garena Free Fire- World Series	Yes
18	Disney+	Yes
19	Marvel Contest of Champions	Yes
20	Toon Blast	Yes
21	DRAGON BALL Z DOKKAN BATTLE	Yes
22	Township	Yes
23	Clash Royale	Yes
24	Summoners War	Yes
25	House of Fun: Free Casino Slots & Casino Games	Yes
26	Fishdom	Yes
27	Star Wars™: Galaxy of Heroes	Yes
28	King of Avalon: Dominion	Yes
29	Empires & Puzzles: Epic Match 3	Yes
30	Vegas Slots - DoubleDown Casino	Yes
31	PUBG MOBILE - NEW MAP KARAKIN	Yes
32	RAID: Shadow Legends	Yes
33	Toy Blast	Yes
34	Golf Clash	Yes
35	Clash of Kings : Newly Presented Knight System	Yes
36	Twitch: Livestream Multiplayer Games & Esports	Yes
37	POP! Slots ™- Free Vegas Casino Slot Machine Games	Yes
38	Last Shelter: Survival	Yes
39	Huuuge Casino™ Free Slots & Best Slot Machines 777	Yes
40	Cashman Casino: Casino Slots Machines! 2M Free!	Yes
41	MARVEL Strike Force - Squad RPG	Yes

Rank	App Name	In Apple App Store?
42	Guns of Glory: The Iron Mask	Yes
43	Mobile Strike	Yes
44	Merge Dragons!	Yes
45	Rise of Kingdoms: Lost Crusade	Yes
46	DoubleU Casino - Free Slots	Yes
47	Big Fish Casino - Play Slots and Casino Games	Yes
48	Slots: Heart of Vegas™ – Free Casino Slots Games	Yes
49	World Series of Poker WSOP Free Texas Holdem Poker	Yes
50	Star Trek™ Fleet Command	Yes
51	Solitaire TriPeaks: Play Free Solitaire Card Games	Yes
52	天堂M	No
53	Design Home: House Renovation	Yes
54	Farm Heroes Saga	Yes
55	State of Survival: The Walking Dead Collaboration	Yes
56	Genshin Impact	Yes
57	Final Fantasy XV: A New Empire	Yes
58	Caesars Slots: Casino & Slots For Free	Yes
59	Cash Frenzy™ Casino – Free Slots Games	Yes
60	Call of Duty®: Mobile - Tokyo Escape	Yes
61	Hay Day	Yes
62	Fate/Grand Order (English)	Yes
63	Evony: The King\'s Return	Yes
64	8 Ball Pool	Yes
65	Game of Thrones: Conquest ™ - Strategy Game	Yes
66	Wizard of Oz Free Slots Casino	Yes
67	Fire Emblem Heroes	Yes
68	Cookie Jam™ Match 3 Games | Connect 3 or More	Yes
69	Pet Rescue Saga	Yes
70	Best Fiends - Free Puzzle Game	Yes
71	TikTok	Yes
72	Solitaire Grand Harvest - Free Solitaire Tripeaks	Yes
73	Mafia City	Yes
74	Lotsa Slots - Free Vegas Casino Slot Machines	Yes
75	AFK Arena	Yes
76	War and Order	Yes
77	Quick Hit Casino Games - Free Casino Slots Games	Yes
78	Bingo Bash featuring MONOPOLY: Live Bingo Games	Yes
79	BIGO LIVE–Live Stream, Live Chat, Go Live	Yes
80	Matchington Mansion	Yes
81	Hit it Rich! Lucky Vegas Casino Slot Machine Game	Yes
82	Boom Beach	Yes
83	Hero Wars – Hero Fantasy Multiplayer Battles	Yes

Rank	App Name	In Apple App Store?
84	Epic Seven	Yes
85	YAHTZEE® With Buddies Dice Game	Yes
86	Castle Clash: Guild Royale	Yes
87	Top War: Battle Game	Yes
88	Angry Birds 2	Yes
89	Klondike Adventures	Yes
90	The Walking Dead: Road to Survival	Yes
91	Zynga Poker – Free Texas Holdem Online Card Games	Yes
92	Lily's Garden	Yes
93	ESPN	Yes
94	Game of Sultans	Yes
95	Gold Fish Casino Slots - Free Slot Machine Games	Yes
96	Minecraft	Yes
97	myVEGAS Slots: Las Vegas Casino Games & Slots	Yes
98	Candy Crush Jelly Saga	Yes
99	Billionaire Casino Slots - The Best Slot Machines	Yes
100	Choices: Stories You Play	Yes

Sources: Google Transactional Data; Apple App Store, https://www.apple.com/app-store/

Exhibit E3

Public Redacted Version

EXHIBIT 2
FILED UNDER SEAL

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

IN RE GOOGLE PLAY STORE ANTITRUST LITIGATION	Case No. 3:21-md-02981-JD
THIS DOCUMENT RELATES TO:	Case No. 3:21-cv-05227
In re Google Play Consumer Antitrust Litigation, Case No. 3:20-cv-05761-JD	
State of Utah et al. v. Google LLC et al., Case No. 3:21-cv-05227-JD	
Match Group, LLC et al. v. Google LLC et al., Case No. 3:22-cv-02746-JD	

EXPERT REPORT OF DR. GREGORY K. LEONARD

November 18, 2022

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I. QUALIFICATIONS

1. My name is Gregory K. Leonard. I am an economist and Vice President at Charles River Associates, 601 12th Street, Suite 1500, Oakland, CA 94607.

2. I received a Bachelor of Science in Applied Mathematics-Economics from Brown University in 1985 and a Ph.D. in Economics from the Massachusetts Institute of Technology in 1989. After receiving my Ph.D., I became an assistant professor at Columbia University. I subsequently moved into economic consulting and worked at several economic consulting firms prior to joining CRA.

3. My specialties within economics are applied microeconomics, the study of the behavior of consumers and firms, and econometrics, the application of statistical methods to economics data. I have published more than sixty articles in scholarly and professional publications, which are listed on my curriculum vitae, which is attached as Appendix A. Many of these articles address issues in industrial organization, antitrust, and econometrics.

4. I am the Vice Chair for Economics of the Board of Editors of the *Antitrust Law Journal* and have served as a referee for numerous economics and other professional journals. I have given invited lectures on antitrust issues at the Federal Trade Commission (FTC), the United States Department of Justice (DOJ), the Directorate General for Competition of the European Commission, the Fair Trade Commission of Japan, and China's Supreme People's Court and Ministry of Commerce. I have been retained by the DOJ to consult on antitrust matters.

5. In 2007, I served as a consultant to, and testified before, the Antitrust Modernization Commission, which was tasked by Congress and the President of the United States to make recommendations for revising U.S. antitrust laws.

6. I have substantial experience in the smartphone and software industries, having served as an economics expert in litigation matters involving Google, Samsung, SAP, Box, and Qualtrics, among others.

7. I have served as an expert witness in a number of litigation matters before U.S. District Courts, state courts, arbitration panels, and the U.S. International Trade Commission. A list of cases in which I have testified (in deposition or at trial) in the last five years is provided in Appendix A. My hourly rate for this matter is $1,200. My or CRA's compensation is not contingent on the outcome of the case.

II. Assignment

8. I have been asked by counsel for Google to review and respond to the damages analyses contained in the expert reports of Dr. Hal Singer (consumer class), Dr. Mark Rysman (States), Mr. Saul Solomon (States), and Dr. Steven Schwarz (Match) (respectively, "the Singer Report," "the Singer Class Report," "the Singer Class Rebuttal Report," "the Rysman Report," "the Solomon Report," and "the Schwartz Report").

9. For the purposes of the damages analysis, I assume liability, although I understand that Google contests plaintiffs' antitrust liability allegations. The information I have considered in forming my opinions for this report is noted throughout the report and includes the materials listed in Appendix B. I reserve the right to supplement my report, for example, if additional information becomes available.

III. Summary of Opinions

10. I have reached the following opinions:

Plaintiffs' Experts Fail to Describe the But-For World

a. Compensatory damages is the difference between the financial position the plaintiff would have been in a world "but for" the alleged unlawful conduct and the plaintiff's financial position in the actual world. When calculating compensatory damages, the "construction" of the but-for world is a critical step. If the but-for world is incorrectly specified, the damage calculation based on comparing the actual world to the but-for world will be fundamentally flawed.

b. Plaintiffs' experts offer damages models without defining, with clarity, the but-for world that would have existed absent the alleged Google conduct. For example, Dr. Rysman offers a damages model based on the assertion that developers would have introduced more Android apps in the but-for world if Google charged a lower service fee. Yet, he does not identify a single developer that decided against launching an app due to the level of Google's service fee in the actual world, or identify a single app that would have been introduced had Google's service fee been lower. Dr. Singer offers a damages model where a crucial input is the share of competing app stores in the but-for world, yet he does not identify any of the stores, what their entry or pricing strategies would have been, or how long it would have taken for them to achieve the market share that Dr. Singer assumes they would have. The failure to adequately define the but-for world makes Plaintiffs' experts' damages models fundamentally flawed.

c. While Plaintiffs' experts offer a number of different models and approaches to estimating damages, their failure to define adequately and clearly the but-for world results in damages models that are inconsistent with one another in important respects. For example, Dr. Schwartz (Match's expert) assumes zero pass-through of service fees, while Dr. Singer (Consumer Plaintiffs' expert) assumes a 91.1% pass-through rate, including a 81.4% pass-through rate for dating apps, and Dr. Rysman (the States' expert) assumes 100% pass-through for all apps. Another example is that Dr. Singer offers a damages model based on the proposition that Google would greatly increase its consumer subsidy to users, while Dr. Rysman's consumer subsidy damages model assumes Google would have the same subsidy but introduce it earlier. This lack of consistency among the various damages models reflects that Plaintiffs' experts have not grounded their damages models in a well-specified construction of the but-for world.

Dr. Singer's and Dr. Rysman's Pass-Through Models Are Flawed

d. Dr. Singer uses a theoretical model to support his opinion that lower service fees in the but-for world would have been passed through to consumers by app developers at a rate of 91.1%. Dr. Rysman assumes 100% pass-through. Both experts base their pass-through rates on unsupported assumptions regarding the demand for paid downloads, in-app purchases, and subscriptions. Moreover, Dr. Singer ignores that service fees are assessed on an *ad valorem* basis and both experts ignore that developers' focal-point pricing can result in even lower or non-existent pass-through rates. Thus, the pass-through rate is an

empirical question that must be directly analyzed. Neither Dr. Singer nor Dr. Rysman performed a valid empirical analysis of pass-through.

e. I have conducted an empirical analysis of pass-through of Google Play service fees based on actual changes in the service fees that have occurred and how app prices changed in response and find that a conservative estimate of the aggregate pass-through rate is 3%, much lower than Dr. Singer and Dr. Rysman assume. Correcting their error substantially reduces their consumer damages in their models.

Dr. Singer's Calculations of Damages to Consumers in the Putative Class are Flawed

f. Dr. Singer calculates consumer damages based on an overcharge theory using a theoretical model. In addition to substantially overstating the pass-through rate, Dr. Singer uses other badly flawed inputs to his model. For example, he overstates Google Play's share in the actual world. His estimate of Google Play's share in the but-for world is based on an unsupoort and inappropriate benchmark—AT&T's share of long-distance wireline telephone service in the early 1980s. As a result of Dr. Singer's flawed assumptions, he substantially overstates the overcharge damages.

g. Dr. Singer also calculates consumer damages based on the theory that Google would have provided more subsidies in the but-for world. Because he uses the same flawed theoretical model as he uses for his overcharge damages model, his consumer subsidy damages are also substantially overstated.[1]

h. Finally, Dr. Singer calculates consumer subsidy damages using Amazon Coins as a benchmark for Google's loyalty program, Google Play Points. However, Amazon Coins operates in a fundamentally different way than Google Play Points, and Dr. Singer ignores other differences between Google Play and the Amazon App Store that make Amazon Coins an inappropriate benchmark for calculating damages in this case.

Dr. Rysman's Calculations of Damages to Consumers in the Plaintiff States Are Flawed

i. Dr. Rysman calculates consumer overcharge damages by assuming that the but-for service fee rate would have been 15% and would have been passed-through to consumers at a rate of 100%. As noted above, 100% pass-through is inconsistent with the empirical evidence. Dr. Rysman bases his 15% but-for service fee rate on a set of benchmarks. However, the benchmarks he cites have service fees that range as high as 30%. He provides no reasonable explanation for why the but-for commission rate is not 25% or even 30% given

[1] Dr. Singer also calculates "hybrid" damages based on a combination of overcharges in service fees and reduced consumer subsidies. These "hybrid" calculations are flawed for the same reasons as the individual calculations.

his own benchmarks charge rates at this level. As a result, Dr. Rysman's overcharges damages calculation is substantially overstated.

j. Dr. Rysman also calculates what he calls consumer "variety" damages on the theory that if Google charged a lower service fee, developers would have introduced more apps in the but-for world, and consumers were harmed by less app "variety." These calculations are flawed for numerous reasons.

- Dr. Rysman's variety damages are calculated based on a highly abstract theoretical model that is completely divorced from the realities of the marketplace.[2] For example, Dr. Rysman's model assumes that all apps are the same in terms of their quality, demand, marginal cost, and cost of entry. As a consequence, in Dr. Rysman's model, all apps have the same price, quantity sales, and profitability. In reality, apps vary widely in their prices, quality, costs, and quantity sales. Dr. Rysman's assumption leads his model to substantially overstate "variety" damages. Because Dr. Rysman's model assumes all apps are the same, it assumes that, in particular, the apps that did not enter in the actual world, but would have entered in the but-for world, are of the same quality as the apps that were present in the actual world. However, basic economics suggests that the apps developers did not introduce in the actual world were of lower quality or higher cost than apps that were present in the actual world. Thus, even if these low quality/high cost apps would have been available in the but-for world (which is not the case for several reasons), they would have generated substantially less value for consumers than Dr. Rysman's model assumes.

- Dr. Rysman's model makes further simplifying assumptions, such that consumers have perfect information about all apps in the Google Play store and that apps do not exhibit direct network effects. I demonstrate that relaxing these assumptions in Dr. Rysman's model would decrease his damages calculation. For example, if apps have direct network effects (as would be expected in dating apps and certain games, for example), an increased number of apps in the but-for world would have decreased the direct network effects for existing apps, which would have harmed consumers who use those apps. This is an offset to Dr. Rysman's variety damages, and accordingly his variety damages must be reduced by this harm to consumers.

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[2] Dr. Rysman also calculates "hybrid" damages based on combinations of overcharges in service fees, reduced consumer subsidies, and foregone variety. These hybrid calculations are flawed for the same reasons discussed for each individual calculation.

- Dr. Rysman's "variety" damages model is based on the theory that an increase in costs to developers will result in fewer apps being introduced and a loss in consumer welfare. However, Dr. Rysman fails to account for increased costs to developers in the but-for world, such as the increased costs to distribute apps through multiple app stores or forked Android devices. Thus, this model is flawed because it fails to account for the decrease in consumer welfare brought about by the increase in costs to developers.

Mr. Solomon's Disgorgement and Restitution Calculations Are Flawed

k. Mr. Solomon bases his disgorgement and restitution calculations on Dr. Singer's and Dr. Rysman's damages models. Because those models are flawed, Mr. Solomon's disgorgement and restitution calculations are flawed as well.

l. Additionally, Mr. Solomon's disgorgement calculation suffers from a conceptual error. From an economics standpoint, a group should be entitled only to a portion of the "ill-gotten profits" that reflects the relative antitrust harm it sustained compared to other groups. Otherwise, there would necessarily be multiple recovery of the same "ill-gotten profits." Mr. Solomon has not performed the necessary apportionment to consumers, his disgorgement calculation is substantially overstated as a remedy for consumers.

Dr. Schwartz's Calculations of Match's Damages Are Flawed

m. Dr. Schwartz calculates damages for the Match Plaintiffs under the assumption that Google would have changed its pricing strategy in the but-for world by breaking the Google Play service fee into (1) a fee for Google Play's billing system and (2) a fee for other Play store services equal to the value of such services to a given app. However, Dr. Schwartz's damages model and calculations are flawed for numerous reasons.

n. First, Dr. Schwartz's model makes unsupported assumptions about Google's fee structure in the but-for world, including that (1) Google would only charge a small fee, akin to a payment processing fee, for in-app purchases (IAPs) processed through Google Play's billing system and charge separately for Play's value for app discovery and delivery; (2) Google would not charge for any other value that Play provides developers; and (3) Google would charge nothing for IAPs processed through an alternative billing system. Moreover, Dr. Schwartz does not explain how his claimed but-for fee structure would work for other app developers, for whom the value of other Play services is greater than the service fee in the actual world.

o. Second, Dr. Schwartz bases his estimate of the amount Match would pay for app discovery and delivery based on an internal Google analysis of the potential value of those services, which he says would inform the starting point for negotiations between Google and Match

regarding the fee for those services. However, the analysis Dr. Schwartz relies upon was [redacted] Moreover, Dr. Schwartz cherry-picked only one of the iterations—the one that yielded the lowest value of Play to the Match Plaintiffs—and used it to represent the end point of what Google and Match would have negotiated regarding the service fee in the but-for world. Dr. Schwartz also gives no explanation why the other iterations would not have also informed the parties' bargaining positions in the but-for world. Had Dr. Schwartz used any of the other iterations, his calculated damages would have been much lower than he estimated, or even negative, meaning that Match would have paid Google more in the but-for world than it paid in the actual world.

p. Third, even accepting Dr. Schwartz's damages model, he ignores that Match would have still owed fees for app discovery and delivery for Match apps that did not use Google Play's billing system. Accounting for the fees on these transactions would result in a substantial offset to Dr. Schwartz's calculated damages.

Damages Calculations Based on Alternative Assumptions

q. I have performed a consumer damages calculation based on the assumption that, in the but-for world, Google would have alternatively offered its current (2022) service fee rate structure starting from the beginning of the damages period but would have left its consumer subsidy rate at its actual levels. I calculate consumer damages to be up to [redacted]

r. I have separately performed a consumer damages calculation based on the assumption that, in the but-for world, Google would have offered its consumer subsidy rate after the Play Points program was launched in the U.S. in November 2019 at an earlier point in time but would have left its service fee rate at its actual levels. I calculate consumer damages based on Play Points to be up to [redacted] and consumer damages based on non-Play Points discounts to be up to [redacted]

s. I have also used these alternative damages models to calculate an alternative measure of restitution. As I noted above, with respect to disgorgement, from an economics standpoint, consumers should only be entitled to a portion of the "ill-gotten gains" that reflect the antitrust harm they suffered. However, for completeness, I have calculated an alternative measure of disgorgement based on my alternative damages models without any apportionment.

t. I have calculated Match Plaintiffs' damages under the assumption that the 2022 Google Play service fees would have been in effect from the beginning of the Match Plaintiffs' damages period. Applying these service fees to Match Plaintiffs' transactions processed through Google Play's billing system results in Match paying in the actual world an additional [redacted] in service fees for the period from 7/7/2017 – 12/31/2021 and

[redacted] for the period from 5/9/2018 – 12/31/2021 than they would have paid in the but-for world. However, I also find that Google would have charged a service fee for Match Plaintiffs' transactions that were not processed through Google Play's billing system and Match would have to pay these service fees to Google in the but-for world. Accounting for the but-for fees owed to Google for the Match Plaintiff's revenues processed using third-party billing services, damages for both periods are negative (i.e., Match Plaintiffs' would owe more to Google than the alleged excess services fees it paid to Google). Thus, Match Plaintiffs are not entitled to any damages.

IV. Overview of Plaintiffs' Experts' Approaches

11. The various Plaintiffs' experts have, collectively, offered a wide variety of calculations (damages, disgorgement, and restitution) using a wide variety of approaches and inputs. As I discuss in detail below, their assumptions and approaches often contradict each other. In this section, I summarize each calculation.

A. Consumers and States

12. Both Dr. Singer and Dr. Rysman perform calculations of what they assert are damages to consumers as a result of the alleged Google conduct. In addition, Dr. Solomon performs calculations of disgorgement of Google's profits due to the alleged conduct and restitution to consumers for the effects of the alleged conduct.

1. "Overcharge" Damages to Consumers

13. The first approach to consumer damages, taken by both Dr. Singer and Dr. Rysman, is to calculate the alleged "overcharges" paid by consumers on paid app downloads, IAPs, and subscriptions obtained via the Google Play store. These alleged overcharges arose, according to Drs. Singer and Rysman, because Google would have charged app developers a lower service fee rate absent the alleged Google conduct and app developers would have lowered their download, IAP, and subscription prices to consumers in response to the lower service fee rate. The two key inputs to Dr. Singer's and Dr. Rysman's overcharge damages calculations are therefore (1) the

service fee rate that Google would have charged in the "but-for world" and (2) the extent to which app developers would have passed the service fee rate savings through to consumers.

14. As discussed in detail below, Dr. Singer's and Dr. Rysman's calculations are flawed because both their assumed pass-through rates are too high, as demonstrated in particular by empirical evidence, and their assumed but-for Google Play service fee rates are too low, again as demonstrated by empirical evidence.

2. "Consumer Subsidy" Damages to Consumers

15. The second approach to consumer damages taken by both Dr. Singer and Dr. Rysman is to calculate the extent to which "consumer subsidies" provided by Google to consumers were lower than they allegedly would have been absent the alleged Google conduct. The consumer subsidies in question include Google Play Points ("Play Points"), which consumers earn from purchases in the Google Play store and can redeem to make future purchases, and other discounts that Google provides to consumers. According to Drs. Singer and Rysman, in the but-for world, Google would have been forced by greater competition to provide greater amounts of Play Points to consumers, but they offer inconsistent models of how Google would provide more Play Points in the but-for world. Dr. Rysman asserts that Google would have started offering the Google Play Points program earlier in the but-for world than it did in the actual world, but that the program would otherwise have been the same; he assumes that the non-Play Points discounts would have remained the same as in the actual world. Dr. Singer asserts that Google would have started offering the Play Points program earlier in the but-for world than it did in the actual world and that Google would have increased the subsidy amount provided through Play Points and other discounts. The key input to the consumer subsidy damages calculations is the amount by which Google Play

Points would have been greater in the but-for world than the actual world at each point in time during the alleged damages period.

16. As discussed in detail below, Dr. Singer's consumer subsidy damages calculations are flawed because the calculations suffer from all the flaws of Dr. Singer's two-sided platform pricing model as discussed in Section VI. B.

3. "Variety" Damages to Consumers

17. Dr. Rysman (but not Dr. Singer) provides a consumer damages calculation based on the assertion that there would have been a large number of additional Android apps in the but-for world and this additional "variety" of apps would have created substantial additional value for consumers. Dr. Rysman relies on a highly stylized economic model of supply and demand for apps to both predict the number of additional apps that allegedly would have existed in the but-for world and the value that consumers allegedly would have placed on these additional apps.

18. As discussed in detail below, Dr. Rysman's variety damages calculation is flawed and highly speculative because the theoretical model on which it is based makes numerous assumptions that both are inconsistent with the real world and lead to an overstatement of the damages calculated using the model.

4. "Hybrid" Damages to Consumers

19. Both Dr. Singer and Dr. Rysman perform "hybrid" calculations that combine one or more of the overcharge, consumer subsidy, and variety calculations described above. Specifically, Dr. Singer performs a hybrid overcharge and consumer subsidy calculation and Dr. Rysman performs a hybrid overcharge and variety calculation. These hybrid calculations are flawed for the same reasons that each of the component calculations is flawed.

5. Disgorgement of Google Profits

20. The States' expert Mr. Solomon performs a "disgorgement" calculation in which he claims to identify the amount of additional profit Google made as a result of the alleged conduct. He calculates separate disgorgement amounts based on Dr. Singer's and Dr. Rysman's multitude of models, as discussed in Section X. A. Specifically, Mr. Solomon projects what Google's revenues and costs allegedly would have been in the but-for world and compares those to Google's actual revenues and costs. The key inputs to his calculations are (1) the Google Play market share in the actual and but-for worlds, (2) the Google Play service fee rate in the but-for world, (3) the Google Play consumer subsidy rate in the but-for world, and (3) the elasticity of demand for paid apps, IAPs and subscriptions.

21. As discussed in detail below, Mr. Solomon's calculation is flawed because the figures he uses for the but-for Google Play market share and commission rate—inputs Mr. Solomon received from other Plaintiffs' experts—are understated, while the inputs he uses for the actual Google Play market share and but-for Google consumer subsidy are overstated.

6. Restitution to Consumers

22. Mr. Solomon also performs "restitution" calculations in which he claims to identify the additional amount of money consumers would have possessed but for the alleged Google conduct. He calculates the additional amount of revenue Google received in the actual world as compared to what it would have received in the but-for world and then multiplies by the pass-through rate. The result is Mr. Solomon's first restitution calculation (the revenue-based restitution). It is similar in nature to Dr. Singer's and Dr. Rysman's overcharge damages calculations. Mr. Solomon goes on to adjust the first restitution calculation downward by the extent to which Google's costs allegedly were higher in the actual world than they would have been in the but-for world. The result is Mr. Solomon's second restitution calculation (the profit-based restitution). This version

of the restitution calculation is similar in nature to the disgorgement calculation, except that it only considers the percentage change in Google's revenue per transaction (i.e., the price effects) and adjusts the disgorgement for the rate at which app developers pass-through the service fee rate to consumers, in an attempt to limit the calculation to consumers. The key inputs to these restitution calculations are (1) the but-for Google Play service fee rate, (2) the but-for Google consumer subsidy rate, (3) the actual and but-for Google Play market shares, and (4) the pass-through rate.

23. As discussed in more detail below, Mr. Solomon's restitution calculations are flawed because the values he uses for the key inputs (which he received from other Plaintiffs' experts) are either overstated (in the case of the actual Google Play market share, the but-for Google consumer subsidy rate, and the pass-through rate) or understated (in the case of the but-for Google Play service fee rate and market share).

B. Match Plaintiffs

24. Dr. Schwartz performs a calculation of what he claims are the damages to the Match Plaintiffs as a result of Google's alleged conduct. He takes the difference between the service fees Match Plaintiffs paid to Google and what he says the services provided by Google Play and Google Play's billing system were worth to the Match Plaintiffs. The key inputs to this calculation are the value that the Match Plaintiffs received from Google Play and the alleged "market price" for Google Play's billing system, which Dr. Schwartz compares to payment processors. Dr. Schwartz's model assumes that this lower service fee would not have been passed through to consumers in the form of lower prices, in direct conflict with the overcharges and hybrid damages models offered by Dr. Singer and Dr. Rysman. Moreover, the implication of Dr. Schwartz's model is that Google would have changed its monetization strategy in a way that would have resulted in

Google charging some developers more fees than they currently pay, which also conflicts with the underlying damages models proposed by Dr. Singer and Dr. Rysman.

25. As discussed in detail below, the Match Plaintiffs' damages calculation is flawed and unsupported because it (1) is based on the assumption that Google could not have continued to charge for Google Play's value as a percentage of consumer spend on IAP even when an alternative billing option is used; (2) assumes that Google would have changed its monetization strategy from one where it charges a service fee on IAPs to one where it charged separate fees for payment processing and other services provided by Google Play, and (3) substantially understates the value the Match Plaintiffs received from Google Play. In addition, unlike Drs. Singer and Rysman who assert that developers passed through all or nearly all the alleged service fee overcharge to consumers, Dr. Schwartz implicitly assumed that Match Plaintiffs would not have passed through any of their but-for service fee savings to consumers.

V. Background

A. Compensatory Damages and Construction of the But-For World

26. To an economist, compensatory damages should return a plaintiff to the financial position it would have been in absent the unlawful conduct. Accordingly, an economist defines compensatory damages as the difference between the financial position the plaintiff would have been in the "counterfactual world" that would have existed "but for" the alleged unlawful conduct and the plaintiff's financial position in the actual world. I understand that this definition accords with the legal definition.

27. The "construction" of the but-for world is a crucial step in a compensatory damages calculation. If the but-for world is incorrectly specified, the damage calculation based on comparing the actual world to the but-for world will be fundamentally flawed and will not properly

return the plaintiff to the financial position it would have been in absent the alleged misconduct. Specifying the but-for world is a complex undertaking in a case such as this one because the various relevant economic actors—including the defendant, the plaintiffs, and third parties—would be expected to respond to the absence of the alleged unlawful conduct in the but-for world by changing their behavior from what they did in the actual world. These changes in behavior in the but-for world can affect the damages calculation. As a simple example, suppose a defendant is alleged to have monopolized a market by imposing a particular restriction on its customers. In the absence of that restriction (the complained-of conduct), the extent of the customers' damages typically would depend on what third parties would have entered the market, when they would have entered, and what product(s) they would have offered in the but-for world. A failure to analyze and specify these important aspects of the but-for world would result in an unsound damages calculation.

28. In this case, the important aspects of the but-for world that are relevant for Plaintiffs' experts damages calculations, but that they either did not address at all or did not address clearly, include (1) what app stores or types of app stores would have entered, when would they have entered, what devices would they be on, and which apps would have been available in those stores; (2) how Google would have changed its level of investment in Android, Google Play and app developer support; (3) if, how, and why Google would have changed its monetization strategy; (4) how consumers would have been affected by the existence of additional app stores (e.g., greater search costs or increased malware on Android devices); (5) how developers would have been affected by the existence of additional app stores and/or multiple Android-based OSs (e.g., greater distribution costs required with multiple stores or multiple OSs); (6) to the extent there is a claim

that there would have been additional apps in the but-for world, the identity, attributes, and quality of those apps; and so on.

29. Rather than grappling with these important issues regarding the workings of the but-for world, Plaintiffs' experts ignored them and went straight to making claims about a limited set of assumed outcomes in the but-for world, such as the but-for Google Play share and the but-for Google Play service fee rate. Among other things, a company's market share will depend on who its competitors are, what attributes the competitors' services offer, and the strategy that the company uses to compete with these competitors. However, Plaintiffs' experts purport to estimate Google's market share in the but-for world without identifying which app stores would have competed with Google Play, what attributes those stores would have offered developers and consumers, and which monetization strategy Google would have used to try to compete with those app stores. As discussed below, Plaintiffs' experts' attempts to circumvent the problem of having to specify the economic conditions in the but-for world render their analyses invalid and result in conflicts and inconsistencies across their damages models.

B. Pass-Through of the Service Fee Rate

30. As noted above, the extent to which app developers charge higher prices for paid app downloads, IAPs, and subscriptions in response to the Google Play service fee rate is a key input to a number of the Plaintiffs' experts' damage calculations. Charging a higher (or lower) price in response to a higher (or lower) marginal cost is often referred to as "marginal cost pass through [or 'pass on']." The "pass-through rate" is defined as the change in price divided by the change in marginal cost. As an illustrative example, when the marginal cost of a given product decreases by one dollar, a pass-through rate of 0% means that the product's price would not change in response

to this change in marginal cost, while a pass-through rate of 100% means that the product's price would also decrease by one dollar.

1. Economic Theory of Pass-Through

31. The economics literature has extensively studied marginal cost pass-through.[3] It is well-known that, as a theoretical matter, the pass-through rate can range widely depending on economic conditions such as the shape of the demand curve, substitution possibilities, and the extent of competition. Moreover, other real world market features can also affect the pass-through rate by creating frictions that limit price changes.[4] One example is when there is a fixed cost to a firm changing its prices, such as the cost of analyzing what new price to set. Another example is when a firm has strategic desire to use "focal pricing points," such as setting prices that end in "99."[5] For marginal cost changes of sufficiently small size, a firm may not change its prices to avoid incurring the fixed cost of changing prices or to stay at a particular focal pricing point. For these reasons, it is inappropriate as a matter of economics to assume that the pass-through rate is 100% or any other particular value for a given firm or industry. Instead, the size of the pass-through rate in a given economic context is an empirical question that must be addressed using empirical analysis.

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[3] See, example.g., J. Bulow and P. Pfleiderer, "A Note on the Effect of Cost Changes on Prices," *Journal of Political Economy*, Vol. 91, 1983; J. Hausman and G. Leonard, "Efficiencies From the Consumer Viewpoint," *George Mason Law Review,* 7, 1999; G. Weyl and M. Fabinger, "Pass-Through as an Economic Tool," *Journal of Political Economy*, Vol. 121, 2013. D. Besanko, *et al.*, "Own-Brand and Cross-Brand Retail Pass-Through," *Marketing Science*, Vol. 24, 2005 provides an empirical analysis that shows that marginal cost pass-through rates can differ even among various products sold in the same supermarkets.

[4] See, e.g., Deng, Fei, John Johnson, and Gregory Leonard, "Economic Analysis in Indirect Purchaser Class Actions," *Antitrust*, Vol. 26, 2011, pp. 51-57.

[5] Dr. Singer tries to dismiss focal point pricing as a meaningful friction, even though he did not quantify the impact of focal point pricing on pass-through. Singer Report ¶¶ 405-413. In the context of class-wide impact, Dr. Singer also argues that price stickiness is an important feature in this market. I address his price stickiness argument below.

32. Unlike many marginal costs that are calculated as a particular amount for each unit of output, Google's service fees are calculated as a percentage of revenue (the service fee "rate"), which economists call an *ad valorem* fee. The pass-through of an *ad valorem* service fee differs in important respects from that of a per-unit marginal cost. One such respect is that, for demand curves of certain shapes, the service fee pass-through rate (i.e., the increase in price due to the service fee divided by the size of the service fee change (in dollars)) tends toward zero as marginal cost (other than the service fee) tends toward zero. This means that, in a market where marginal costs are low (relative to price) – as often is the case with software like apps or in-app purchases of digital goods and subscriptions – the service fee pass-through rate can be at or near zero.[6] It also means that in a context where focal point pricing is prevalent – as is the case here – pass-through is less likely unless a developer can adjust to a new focal point price.[7] Thus, a reliable measure of the service fee pass-through rate must be determined using an empirical analysis of the marketplace at issue; the service fee pass-through rate cannot be assumed to be a certain level or determined using only theory.

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6 This can be true even for demand curve shapes for which the marginal cost pass-through rate remains sizable as marginal cost tends toward zero.

7 The prices of many paid downloads, IAPs, and subscriptions are set to end in "99," such as $0.99, $1.99, and $4.99. Based on the Google Play transactions data, during the period from August 2016 to July 3, 2021, [redacted] of U.S. consumers' app transactions were set such that the retail prices ended in "99." Specifically, price is $0.99 for [redacted] of U.S. consumers' transactions, $1.99 for [redacted] of the transactions, $4.99 for [redacted] of the transactions, and $9.99 for [redacted] of the transactions, and other price points ending at "99" for [redacted] of the transactions. The percentage reduction can be as large as 50% from one focal price point to the next one, such as from $1.99 to $0.99. Dr. Singer argues that the observed prevalence of focal pricing in the actual data is due to Google's anti-steering policy. Singer Report ¶ 405 ("A key reason we do not see as much deviation from focal-point pricing in the actual world is that developers are not afforded the opportunity to steer due to the Aftermarket Restrictions."). In other words, Dr. Singer claims that if there is a lower-cost competitor, then one should not observe as many focal prices on Google Play store. The implication that no steering leads to focal pricing makes little sense. Focal pricing is observed in many markets and Dr. Singer does not point to a single study that links focal pricing to the type of steering he considers critical. As noted above, Dr. Singer does not quantify the impact of observed focal pricing on pass-through.

33. In the context of app pricing, it is also possible to observe negative pass-through. This stems from the fact when it comes to monetization, developers have multiple options. They can offer free apps and monetize through advertising; they can offer paid downloads, IAPs, and subscriptions; they can use a combination of both paid content and advertising. All else equal, consumers prefer a lower price and less advertising. From a developer's perspective, trading off consumers' preferences for a lower price and less advertising is an important consideration when choosing ways to monetize. This is widely understood in practice and has become a subject of recent academic research.[8] For example, it is common for developers to offer free apps supported by advertising which can be removed or reduced if consumers make a payment. With a service fee rate reduction, the developer may have the incentive to shift its monetization strategy toward a higher price and less advertising, implying a negative pass-through rate. The following simple example illustrates the intuition. Suppose a developer monetizes through both paid content and advertising. Following a service fee rate reduction, the developer may find it more profitable to increase the price (hence making more profit per sale) and lower the intensity of advertising (hence forgoing advertising revenue but at the same time limiting the reduction in consumer demand due to consumers' preference for less advertising). The more consumers value the app and the more consumers dislike advertising, the more appealing this change in pricing strategy may be for the developer. This would lead to a negative pass-through. These real world complexities that both Dr. Singer and Dr. Rysman ignore further emphasize the importance of treating the pass-through rate as an empirical question. Both Dr. Rysman and Dr. Singer recognize the practical importance

[8] See, e.g., Lambrecht, A., Goldfarb, A., Bonatti, A. et al. How do firms make money selling digital goods online?. Mark Lett 25, 331–341 (2014).

of advertising to developers. However, both fail to consider the fact that the choice between advertising and paid content can lead to negative pass-through as I discussed here.[9]

2. Empirical Analysis of the Google Play Service Fee Pass-Through Rate

34. Google has implemented multiple service fee rate reductions during the class period, with the most recent two occurring on July 1, 2021 and January 1, 2022. The July 1, 2021 change reduced the Google Play service fee rate to 15% for the first $1 million of a developer's global gross earnings from paid downloads and in-app purchases (including subscriptions) in each calendar year after they complete enrollment;[10] and the January 1, 2022 change reduced the Google Play service fee rate to a flat 15% for all subscription sales through the Google Play store.[11] The service fee rate reductions can be used as "natural experiments" to analyze empirically how app developers in the real world adjust their prices when the service fee rate decreases.

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[9] See, e.g., Singer Report ¶ 132 ("Google's conduct vis-à-vis developers—including preventing developers from steering users to rival stores and conditioning developers' access to valuable advertising programs") ¶ 214 ("This conduct further entrenched Google's monopoly in the Android App Distribution Market by coercing developers to list their Apps in the Play Store or risk losing advertising access to some of the Internet's most effective advertising space."). Dr. Rysman made a similar argument. See, for example, Rysman Report footnote 592 ("… some developers do not monetize their in-app content,…, monetizing their app in other ways (e.g., through advertising)") and ¶ 465, arguing that that Google App Campaigns provide many useful services to app developers and advertisers and Google's limitation on Google App Campaign "discourages Android App Distribution competition."

[10] The service fee rate reverts to 30% once the $1 million annual cap (partial year cap of $500,000 for 2021) is reached. Developers must complete enrollment to receive the reduced 15% service fee rate. As noted by Google, the 15% service fee tier will go into effect on July 1, 2021 for all developers who have completed enrollment before this date; for developers who complete enrollment after July 1, 2021 the 15% will be applied starting from the date when enrollment is completed. "Changes to Google Play's service fee in 2021", Play Console Help, https://support.google.com/googleplay/android-developer/answer/10632485; https://www.cnbc.com/2021/03/16/google-app-store-fees-cut-for-developers-on-first-million-in-sales.html: "After developers cross the $1 million in sales for a year, Google will charge developers its standard 30% fee for in-app purchases and downloads.")]

[11] "Evolving Our Business Model to Address Developer Needs," Android Developers Blog, October 21, 2021, https://android-developers.googleblog.com/2021/10/evolving-business-model.html.

35. Overall, I found little evidence of systematic pass-through and my econometric estimates of the pass-through rate are small and not statistically significantly different from zero.

a. Real-World Examples Show Little Evidence of Pass-Through in Response to Reductions in the Google Play Service Fee Rate

36. In this section, I compare prices of the top paid apps, IAPs, and subscription items (or "SKUs"), before and after the SKU had a service fee rate change using Google Play's transactions data. The results show that very few of these top paid apps, IAPs, or subscriptions experienced a price decrease following a reduction in the service fee rate.

i. Paid Apps

37. First, I analyze what happened to the prices of paid apps following the July 1, 2021 service fee reduction. Because this rate reduction applies to a developer's first $1 million of annual global gross earnings once they enroll, the effective service fee rate reduction for a given app can be as much as 15 percentage points (if the app developer's annual gross earnings remain below $1 million[12]) or a figure less than 15 percentage points (if the app developer enrolls and their annual gross global earnings exceed $1 million during the relevant period).

38. I first look at paid apps with the most pronounced change in service fee, i.e., paid apps with a service fee reduction of 15 percentage points (i.e., paid apps for which the service fee rate decreased from 30% to 15%) after July 1, 2021 and compare their prices before and after the service fee rate reduction.[13] As shown in Table 1, among the top 100 paid apps in this group,

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[12] "Changes to Google Play's service fee in 2021," Play Console Help, https://support.google.com/googleplay/android-developer/answer/10632485.

[13] I restrict the sample to paid apps that (1) had non-zero sales in every month between July 2020 and May 2022, (2) were subject to a 30% service fee rate in every month between July 2020 and June 2021, and (3) were subject to a 15% service fee rate in every month between July 2021 and May 2022. Among these paid apps, the top 100,

comparing price during the one year after July 1, 2021 to the price in the one year preceding July 1, 2021, there is little change in the average before and after period prices ($8.37 vs. $8.40); specifically, price was unchanged for 45 apps, price increased for 32 apps, and price decreased for only 23 apps.[14] Figure 1 presents, as an example, the monthly app prices and service fee rates for [redacted], the top paid app in this group ranked by consumer spend.[15] This shows that very few paid apps that experienced a service fee rate reduction of 15 percentage points decreased their prices following the reduction. That is, there is little evidence of positive pass-through in response to the service fee rate reduction.

ranked by consumer spend between July 2020 and May 2022, account for [redacted] of the total consumer spend in the sample.

[14] I use the pre-change period of July 2020 to June 2021 and the post-change period of July 2021 to May 2022, since the Google Play transactions data covers transactions through May 31, 2022. I analyze price changes based on both the list price and the net price. In order to account for price fluctuations of very small magnitude, a price change of less than or equal to 1% (i.e., $0.08 on average) is considered as no price change. To gauge how likely it is that general inflation affects app-related prices, I also examined the relationship between inflation, as measured by the consumer price index and prices of paid download, IAPs, and subscriptions in the recent history and found no statistically significant relationship. I note that my econometric analysis of the pass-through accounts for inflation provided that inflation affects SKUs the same way, on average.

[15] See Exhibit 35a for the monthly app prices and service fee rates between July 2020 and May 2022 of the top 100 apps in this paid app group.

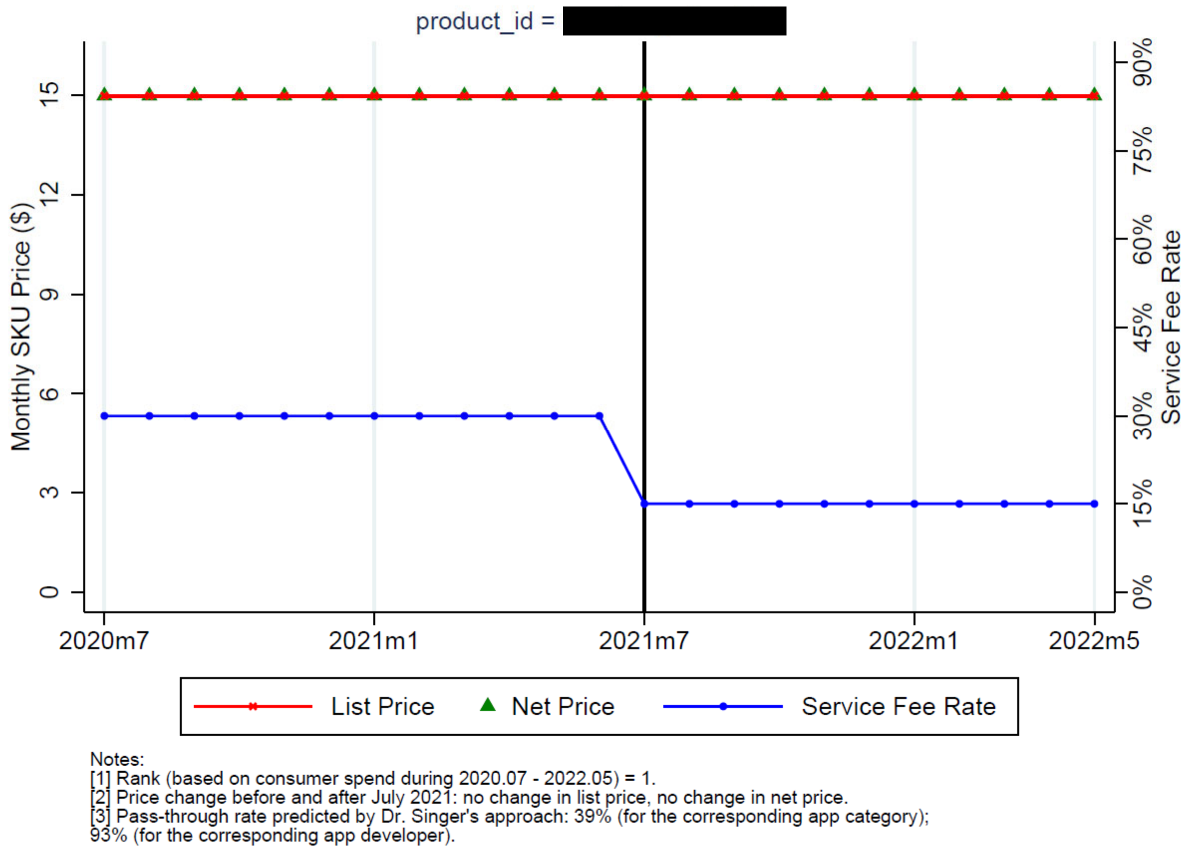
Table 1. Price Changes of the Top 100 Paid Apps with A Flat Service Fee Rate Reduction of 15 Percentage Points After July 2021

July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	45	32	23
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	51%	32%	18%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	15%	15%	15%	15%
Average List Price				
2020.07.01 - 2021.06.30	$8.37	$9.81	$7.30	$7.03
2021.07.01 - 2022.05.31	$8.40	$9.81	$8.15	$5.99
% List Price Change	0%	0%	12%	-15%
Based on Net Price				
Count of SKUs	100	45	32	23
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	51%	32%	18%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	15%	15%	15%	15%
Average Net Price				
2020.07.01 - 2021.06.30	$8.37	$9.81	$7.30	$7.03
2021.07.01 - 2022.05.31	$8.40	$9.81	$8.15	$5.99
% Net Price Change	0%	0%	12%	-15%

Source: See Exhibit 1a.

Figure 1. Average Monthly Product Price and Service Fee Rate of [redacted]



Source: See Exhibit 35a.

39. Next, I analyze paid apps that experienced a service fee rate reduction of at least 10 percentage points in July 2021. The service fee rate could jump back to 30% after July 2021 and the service fee reduction is at most 15 percentage points for this group of apps.[16] Thus, this group of apps is inclusive of the first group with a flat 15 percentage points service fee rate reduction.[17]

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[16] I restrict this sample to paid apps that had a service fee rate reduction of at least 10% in July 2021 (and with non-zero sales in every month between July 2020 and May 2022, subject to a 30% service fee rate in every month between July 2020 and June 2021). I did not require that the service fee rate remain below 30% after July 2021, which allows the sample to include paid apps that exceeded the policy's annual $1M cap ($0.5M for 2021) between July 2021 and May 2022. Among these paid apps, the top 100, ranked by consumer spend between July 2020 and May 2022, account for [redacted] of the total consumer spend of the sample.

[17] The top 100 paid apps in the group with a flat 15% service fee rate reduction and in this group thus overlap with 73 paid apps in the former group also being in this group.

As shown in Table 2, similar to the first group, the average prices of these 100 paid apps before and after the service fee rate reduction show a small increase of 1%; 41 out of the top 100 paid apps in this group had no price change between one year before and after July 1, 2021, 37 had a price increase, and only 22 had a price decrease. The top paid app in this group, [redacted] shows a price increase after July 1, 2021, despite having service fee reductions. See Figure 2.[18]

Table 2. Price Changes of the Top 100 Paid Apps with A Service Fee Rate Reduction of At Least 10 Percentage Points in July 2021

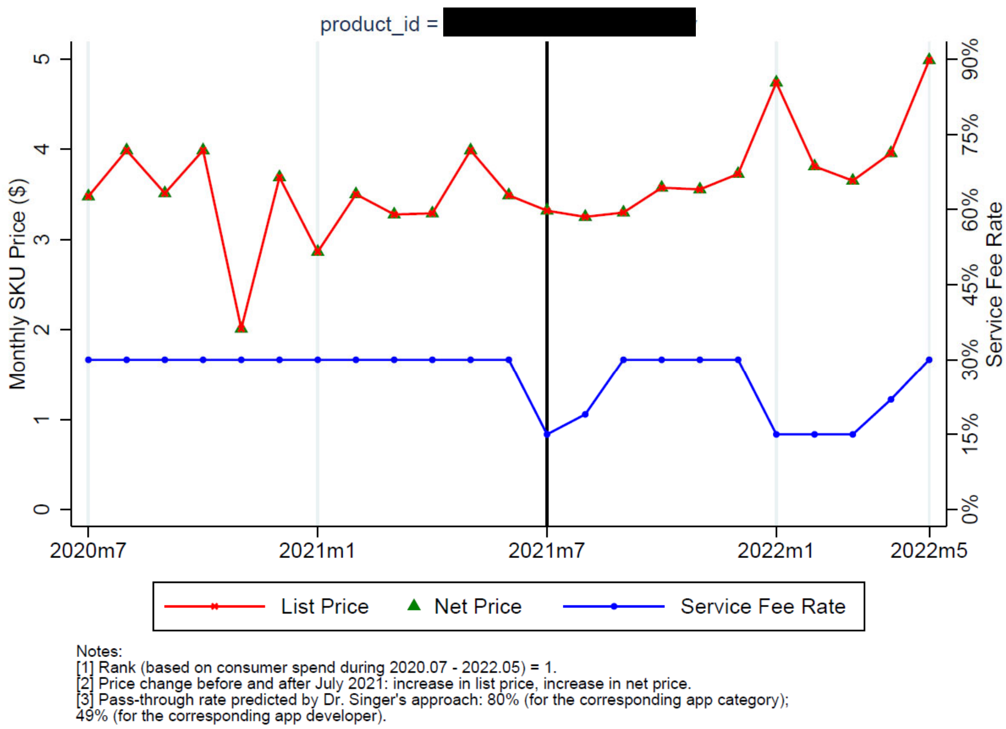
July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	41	37	22
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	46%	38%	16%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	16%	15%	17%	16%
Average List Price				
2020.07.01 - 2021.06.30	$8.10	$10.41	$6.65	$6.22
2021.07.01 - 2022.05.31	$8.18	$10.41	$7.42	$5.34
% List Price Change	1%	0%	11%	-14%
Based on Net Price				
Count of SKUs	100	41	37	22
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	46%	38%	16%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	16%	15%	17%	16%
Average Net Price				
2020.07.01 - 2021.06.30	$8.10	$10.41	$6.65	$6.22
2021.07.01 - 2022.05.31	$8.18	$10.41	$7.42	$5.34
% Net Price Change	1%	0%	11%	-14%

[18] See Exhibit 35b for the monthly app prices and service fee rates between July 2020 and May 2022 of the top 100 apps in this paid app group.

Source: See Exhibit 1b.

Figure 2. Average Monthly Product Price and Service Fee Rate of [redacted] Classic Board Game"



Source: See Exhibit 35b.

40. Lastly, I analyze the prices of the top 100 paid apps ranked by consumer spend among all paid apps. For this group of apps, the service fee rate is between 15% and 30% since July 2021 and the service fee reduction is at most 15 percentage points. On average for this group, the service fee rate decreased from 30% to [redacted].[19] Therefore, this group of top apps experienced smaller (relative to the first two groups discussed above) or no service fee rate reduction. The price changes of apps with no service fee reduction would reflect any common trend in prices driven by

[19] This sample includes all paid apps and is inclusive the first two groups (with a flat 15% service fee rate reduction and with a service fee rate reduction of at least 10% in July 2021). These top 100 paid apps account for [redacted] of the total consumer spend of all paid apps between July 2020 and May 2022. Most of these paid apps are games [redacted] out of 100), such as [redacted]

other factors.[20] Similar to the first two groups, Table 3 shows that on average there was a small increase in app prices after July 1, 2021; 56 of these 100 paid apps had no price change one year before and after July 1, 2021, 32 had a price increase, and only 12 had a price decrease. The top paid app, [redacted] which experienced a small service fee reduction in July 2021 and January 2022 (due to reset of the annual cap), showed no price reduction after the July 1, 2021 service fee reduction. See Figure 3.[21]

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[20] As discussed below, the price changes for these apps are also informative about the potential interdependence between the apps with a service fee reduction and those without.

[21] See Exhibit 35c for the monthly app prices and service fee rates between July 2020 and May 2022 of the top 100 apps in this paid app group.

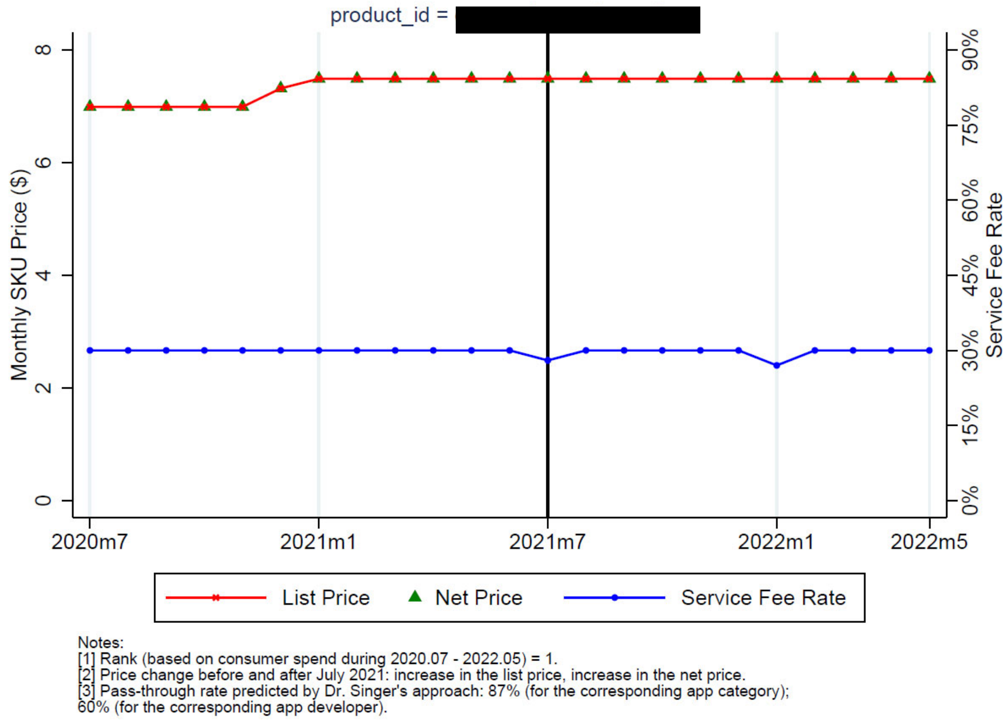
Table 3. Price Changes of the Top 100 Paid Apps

July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	56	32	12
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	36%	55%	9%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	[redacted]			
Average List Price				
2020.07.01 - 2021.06.30	$7.82	$8.31	$6.30	$9.55
2021.07.01 - 2022.05.31	$8.00	$8.31	$7.03	$9.12
% List Price Change	2%	0%	12%	-5%
Based on Net Price				
Count of SKUs	100	56	32	12
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	36%	55%	9%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	[redacted]			
Average Net Price				
2020.07.01 - 2021.06.30	$7.82	$8.31	$6.30	$9.55
2021.07.01 - 2022.05.31	$8.00	$8.31	$7.03	$9.12
% Net Price Change	2%	0%	12%	-5%

Source: See Exhibit 1c.

Figure 3. Average Monthly Product Price and Service Fee Rate of "[redacted]"



Source: See Exhibit 35c.

ii. IAPs

41. Similar to paid downloads, I also analyzed the price changes of IAPs following the July 1, 2021 service fee reduction.[22] The effective service fee rate reduction for a given IAP can be 15 percentage points or less, depending on the size of its developer's total annual gross earnings once they enroll. I first look at the group of IAPs with the most pronounced change in service fee, i.e., IAPs with a service fee reduction of 15 percentage points (i.e., service fee rate reduced from 30% to 15%) after July 1, 2021.[23] As shown in Table 4, among the top 100 IAPs in this group, there

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[22] I look at price changes of IAPs at the stock-keeping units (or SKU) level, as identified by the product ID field in the Google Play transactions data.

[23] I restrict the sample to IAPs with non-zero sales in every month between July 2020 and May 2022, subject to a 30% service fee rate in every month between July 2020 and June 2021, and subject to a 15% service fee rate in

was a small price increase of 4% after the service fee rate reduction; 85 had no price change one year before and after July 1, 2021, 14 had a price increase, and only one had a price decrease. The monthly app prices and service fee rates of the IAP SKU [redacted] of the app [redacted] the top one IAP by consumer spend in this group, shows that the prices of this IAP actually increased right before the service fee rate reduction occurred and stayed flat afterwards. See Figure 4.[24]

every month between July 2021 and May 2022. Among these IAPs, the top 100, ranked by consumer spend between July 2020 and May 2022, account for [redacted] of the total consumer spend of the sample.

[24] See Exhibit 36a for the monthly app prices and service fee rates between July 2020 and May 2022 of the top 100 IAPs in this IAP group.

Table 4. Price Changes of the Top 100 IAPs with A Flat Service Fee Rate Reduction of 15 Percentage Points After July 2021

July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	85	14	1
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	85%	14%	1%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	15%	15%	15%	15%
Average List Price				
2020.07.01 - 2021.06.30	$28.31	$30.08	$19.31	$2.99
2021.07.01 - 2022.05.31	$29.33	$30.08	$26.67	$2.86
% List Price Change	4%	0%	38%	-4%
Based on Net Price				
Count of SKUs	100	85	14	1
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	85%	14%	1%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	15%	15%	15%	15%
Average Net Price				
2020.07.01 - 2021.06.30	$28.31	$30.08	$19.31	$2.99
2021.07.01 - 2022.05.31	$29.33	$30.08	$26.67	$2.86
% Net Price Change	4%	0%	38%	-4%

Source: See Exhibit 2a.

Figure 4. Average Monthly Product Price and Service Fee Rate of the IAP SKU "[redacted]" of the App "[redacted]"

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 1.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 97% (for the corresponding app developer).

Source: See Exhibit 36a.

42. I next analyze IAPs that had a service fee rate reduction of at least 10 percentage points and at most 15 percentage points in July 2021.[25] This group of IAPs is inclusive of the first group of IAPs with a flat 15% service fee rate reduction.[26] As shown in Table 5, there was no price change with these 100 IAPs on average; specifically, 90 of the top 100 IAPs in this group had no price change one year before and after July 1, 2021, 9 had a price increase, and only one had a price decrease. The monthly average price of the top IAP in this group, "Special Offer" associated

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[25] I restrict the sample to IAPs that had a service fee rate reduction of at least 10% in July 2021 (and with non-zero sales in every month between July 2020 and May 2022 and subject to a 30% service fee rate in every month between July 2020 and June 2021). I do not require the service fee rate to remain below 30% after July 2021, which allows the sample to include IAPs that exceeded the policy's annual $1M cap ($0.5M for 2021) between July 2021 and May 2022. Among these IAPs, the top 100, ranked by consumer spend between July 2020 and May 2022, account for [redacted] of the total consumer spend of the sample.

[26] Two IAPs in this group are also in the first group of IAPs with a flat service fee rate reduction of 15%.

with the app [redacted] remains the same before and after July 2021, despite the service fee reduction. See Figure 5.[27]

Table 5. Price Changes of the Top 100 IAPs with A Service Fee Rate Reduction of At Least 10 Percentage Points in July 2021

July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	90	9	1
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	93%	7%	1%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	25%	25%	24%	27%
Average List Price				
2020.07.01 - 2021.06.30	$40.58	$40.28	$42.04	$54.31
2021.07.01 - 2022.05.31	$40.76	$40.29	$44.49	$49.99
% List Price Change	0%	0%	6%	-8%
Based on Net Price				
Count of SKUs	100	90	9	1
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	93%	7%	1%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	25%	25%	24%	27%
Average Net Price				
2020.07.01 - 2021.06.30	$40.58	$40.28	$42.04	$54.31
2021.07.01 - 2022.05.31	$40.76	$40.28	$44.49	$49.99
% Net Price Change	0%	0%	6%	-8%

Source: See Exhibit 2b.

[27] See Exhibit 36b for the monthly app prices and service fee rates between July 2020 and May 2022 of the top 100 IAPs in this IAP group.

Figure 5. Average Monthly Product Price and Service Fee Rate of the IAP SKU "[redacted]" of the App "[redacted]"

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 1.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 99% (for the corresponding app developer).

Source: See Exhibit 36b.

43. Lastly, I compare prices of the top 100 IAPs ranked by consumer spend among all the IAPs.[28] This group of top 100 IAPs experienced no service fee rate reduction and the price changes of these IAPs would reflect any common trend in prices driven by other factors.[29] As shown in Table 6, on average there was no change in app prices after July 1, 2021; none of these 100 IAPs had any change in the list price one year before and after July 1, 2021, and only five had a net price

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28 These top 100 IAPs are ranked by consumer spend between July 2020 and May 2022 among all IAPs. These IAPs are inclusive of the first groups of IAPs and experienced virtually no change in the service fee rate. They account for [redacted] of the total consumer spend of all IAPs between July 2020 and May 2022. Many of these IAPs are attached to popular game apps such as [redacted] and [redacted]

29 As discussed below, the price changes for these apps are also informative about the potential interdependence between the apps with a service fee reduction and those without.

decrease.[30] The top IAP, [redacted] associated with the popular game app "[redacted]" had no change in either the list or net price following the July 1, 2021 service fee reduction. See Figure 6.[31]

Table 6. Price Changes of the Top 100 IAPs

July 2020 – June 2021 vs. July 2021 - May 2022

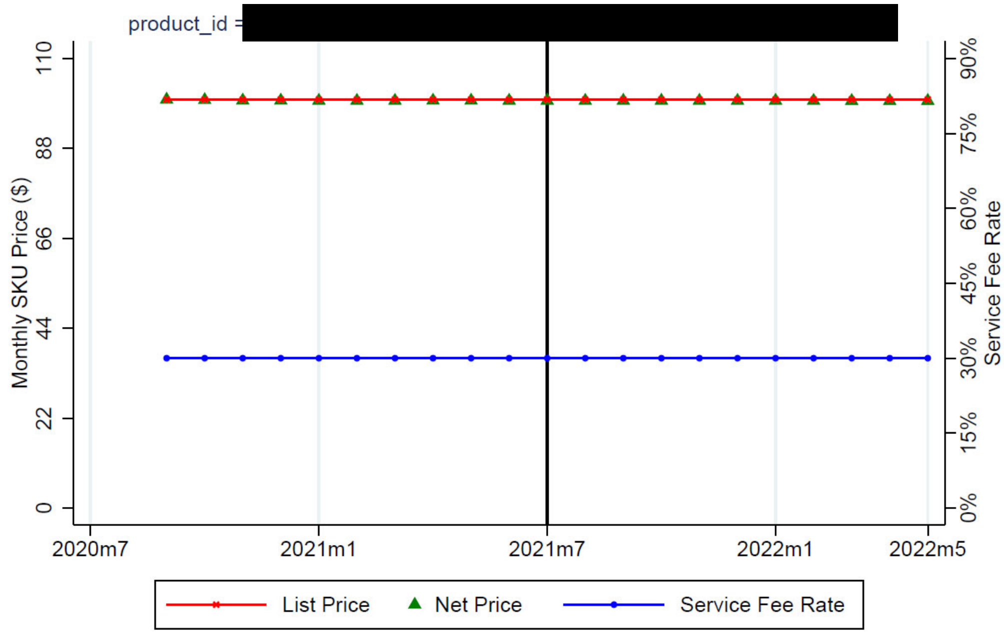
	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	100	0	0
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	100%	0%	0%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	-	-
2021.07.01 - 2022.05.31	30%	30%	-	-
Average List Price				
2020.07.01 - 2021.06.30	$39.92	$39.92	-	-
2021.07.01 - 2022.05.31	$39.92	$39.92	-	-
% List Price Change	0%	0%	-	-
Based on Net Price				
Count of SKUs	100	95	0	5
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	95%	0%	5%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	-	30%
2021.07.01 - 2022.05.31	30%	30%	-	30%
Average Net Price				
2020.07.01 - 2021.06.30	$39.82	$40.66	-	$23.87
2021.07.01 - 2022.05.31	$39.74	$40.64	-	$22.63
% Net Price Change	0%	0%	-	-5%

30 Furthermore, the empirical evidence does not suggest that developers launched new IAPs with lower prices to replace existing IAPs as a way to pass through the service fee rate reductions. Among the apps in the three groups of top 100 IAPs discussed above, only a number of those (31 out of 40 apps in the first group, 25 out of 72 apps in the second group, and 28 out of 57 apps in the third group) launched any new SKUs in the period after July 1, 2021. Even for these cases, the prices of the new IAPs are in some cases higher and in other cases lower than the average prices of the existing IAPs. In addition, the monthly average consumer spend on the new IAPs is generally lower than the spend on existing IAPs during July 2021 to May 2022, and the percentages of consumer spend accounted for by the newly launched IAPs during the period following the July 2021 service fee rate reduction (from July 2021 to December 2021) are generally similar to those during from July 2020 to December 2020, which does not appear to suggest that developers tend to resort more heavily on launching new IAPs in order to pass on the service fee rate reduction compared to the same time period in the year before the service fee rate reduction. See Exhibits 3a-3c.

31 See Exhibit 36c for the monthly app prices and service fee rates between July 2020 and May 2022 of the top 100 IAPs in this IAP group.

Source: See Exhibit 2c.

Figure 6. Average Monthly Product Price and Service Fee Rate of the IAP SKU “[redacted]” of the App “[redacted]”



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 1.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 94% (for the corresponding app developer).

Source: See Exhibit 36c.

iii. Subscriptions

44. Google has reduced the service fee rate for subscriptions multiple times, including the January 1, 2018 change when Google reduced the service fee rate for subscriptions to 15% after a consumer had subscribed for one year[32] and the January 1, 2022 change when Google reduced the

[32] “Google Play Lowers App Subscription Fee to 15 Percent, Matches Apple's Offering,” Gadgets 360, October 20, 2017, https://gadgets.ndtv.com/apps/news/google-play-app-subscription-fee-30-percent-to-15-1764923. Google’s subscription fee rate reduction followed Apple’s 2016 rate reduction on subscriptions. See “Apple Announces it Will Offer App Store Subscriptions to All Apps, Take Smaller 15% Cut,” Apple Insider, June 8, 2016, https://appleinsider.com/articles/16/06/08/apple-announces-it-will-offer-app-store-subscriptions-take-smaller-15-cut.

service fee rate for all subscriptions to 15%.[33] Below I show with Tinder's subscription products (SKUs) that there is little or no evidence of pass-through in response to reductions in the Google Play service fee rate.

45. Tinder has [redacted] subscription SKUs with non-zero sales during the class period of August 2016 to May 2022, of which [redacted] incurred non-zero sales before and after the July 1, 2021 and January 2022 service fee rate reductions.[34] As shown in Table 7, the average service fee rate of these [redacted] SKUs decreased to 15% starting in January 2022, and the average list price of these SKUs *increased* from about [redacted] during July 2020 and June 2021 to about [redacted] in the first five months of 2022.[35] Further, when comparing each subscription SKU's average list prices before and after the January 2022 service fee rate reduction, [redacted] subscriptions out of the [redacted] did not have any price change, [redacted] had a price increase, and only [redacted] had a price drop. The [redacted] subscriptions with price drops account for only [redacted] of the total consumer spend of the 363 subscriptions during the period of July 2020 to May 2022.[36]

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33 "Evolving Our Business Model to Address Developer Needs," Android Developers Blog, October 21, 2021, https://android-developers.googleblog.com/2021/10/evolving-business-model.html.

34 I included Tinder's subscription SKUs that incurred sales during each of the three time periods as shown in Table 7.

35 The service fee rates of the [redacted] subscriptions analyzed in Table 7 differ before January 2022 due to differences in their sales portions from subscriptions longer than one year (which were subject to a 15% service fee rate, starting from the January 2018 Google Play subscription service fee rate reduction) and from subscriptions less than one year (which were subject to a 30% service fee rate, since the January 2018 Google Play subscription service fee rate reduction only applies to subscriptions longer than one year).

36 The total consumer spend on the [redacted] subscription SKUs during the period from July 2020 to May 2022 is [redacted] close to that of the [redacted] subscription SKUs ([redacted], as shown in Table 7). I show in Exhibit 4b that similar results are obtained with Tinder's subscription SKUs with non-zero originating sales. Originating sales refer to the first payment for a recurring app subscription. See 2021.10.11 B. Rocca Letter to G. Arenson re Transactional Data.

[redacted]

46. As further illustrated by the monthly subscription prices and service fee rates for Tinder's top 100 subscriptions ranked by either total consumer spend or originating consumer spend in Exhibits 37a and 37b, the monthly prices of the top 100 subscriptions either remained the same or exhibited an upward trend in general before and after the January 2022 service fee reduction. Thus,

the data do not show any evidence that Tinder decreased its subscription prices after the service fee rate reduction in January 2022.[37]

b. Econometric Esimates of Pass-Through

47. In this section, I econometrically estimate the pass-through rate using the actual observed service fee changes in the recent history.

48. Specifically, as discussed above, starting from July 1, 2021, Google lowered the service fee rate for a developer's first $1 million annual global revenue from 30% to 15%, provided that the developer enrolls in the program. As a result, developers who enroll in the program pay 15% after July 1, 2021, while developers who do not enroll continue to pay 30% service fee on their paid downloads and IAPs.[38] Therefore, comparing and contrasting the price changes *before and after* Google's service fee rate change *between* the paid downloads and IAPs offered by these two types of developers allows me to quantify the extent of pass-through for paid downloads and IAPs.

49. For subscriptions, a group of subscription products paid more than 15% before July 1, 2021 and started paying a lower 15% rate after July 1, 2021 provided that their developers enroll in the program after the July 1, 2021 service fee reduction before reaching the first $1 million annual global revenue cap. The service fee rate for all subscription products was reduced to a flat 15%

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[37] The empirical evidence does not suggest that Tinder launched new subscription SKUs with lower prices to replace existing subscription SKUs as a way to pass through the service fee rate reductions. During January 2022 and May 2022, Tinder launched [redacted] new subscription SKUs, [redacted] This does not support that these new SKUs were launched to replace the popular existing subscription SKUs. Compared to January 2021 to May 2021, [redacted]

[38] There is also a small group of developers whose service fee rate stays close to 30% since their annual revenue far exceeds $1 million.

after another service fee rate reduction for subscriptions since January 1, 2022.[39] Another group of subscription products that were either in a developer deal program (e.g., LRAP, ADAP, SwG) or their sales before July 1, 2021 mostly (or entirely) consisted of sales from subscribers lasting more than 12 months (hence were subject to 15% since the January 1, 2018 subscription rate change) are subject to a constant 15% service fee rate when the service fee rate for the first group of subscription products reduced.[40] Therefore, comparing the price changes *before and after* Google's service fee rate change *between* these two groups of subscription products allows me to quantify the extent of pass-through for suscriptions.

50. The intuition is as follows. Suppose there are two similar products A and B. Product A, known as a "control unit" in econometric terms, paid the 30% service fee rate both before and after the policy change and product B, known as a "treatment unit" in econometric terms, experienced a change in its service fee in July 2021. Any change in the price of product A can be understood as being driven by market factors unrelated to the policy change. Product B, on the other hand, was not only subject to the same market forces as product A but also the service fee rate change. Therefore, the difference between the price changes in product B and product A, before and after the service fee rate change, is a measure of the impact on the price of product B that is attributable to the service fee rate change alone. Because I have multiple treatment and control units in the data, I use a methodology specifically designed for such a situation. The methodology is an

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[39] "Google Play Lowers App Subscription Fee to 15 Percent, Matches Apple's Offering," Gadgets 360, October 20, 2017, https://gadgets.ndtv.com/apps/news/google-play-app-subscription-fee-30-percent-to-15-1764923; "Evolving Our Business Model to Address Developer Needs," Android Developers Blog, October 21, 2021, https://android-developers.googleblog.com/2021/10/evolving-business-model.html.

[40] Google's Living Room Accelerator Program ("LRAP") was introduced in 2016 for developers of subscription video apps. The Subscribe with Google ("SwG") program reduced the service fee rate for news app developers to 15%. The Audio Distribution Accelerator Program ("ADAP") offers audio and music app developers a service fee rate of 15%. See GOOG-PLAY-001291192; GOOG-PLAY-000604733; GOOG-PLAY-003335786.R; GOOG-PLAY-003331764.

extended version of the well-established econometric method known as Synthetic Control.[41] This method is a formal way to combine the control units in an optimal fashion in creating a benchmark for the treated group. I perform the econometric analysis for paid downloads, IAPs, and subscriptions separately. See Appendix C for a detailed discussion of the methodology, the data construction and robustness checks.

51. Table 8 summarizes the results of my econometric analysis. I find that the service fee pass-through rate is not distinguishable from zero statistically for paid downloads, IAPs, or subscriptions. To be conservative, however, in various analyses described below that require an estimate of the service fee pass-through rate, I use the upper bounds of the 95th confidence intervals for pass-through rates, which are 10.6% for paid downloads, 2.0% for the IAPs, and 9.7% for subscriptions. The weighted average pass-through rate (based on the upper bound of the 95th confidence intervals) across the three types of transactions is 3.0%.

Table 8. Estimates of Pass-Through Rate

	IAPs	Paid Downloads	Subscriptions
Pass-Through Rate	[redacted]		
Pass-Through Rate (Upper Bound)			
P-Value	0.22	0.94	0.82
Number of Treated SKUs	16,047	3,113	2,874
Number of Control SKUs	11,507	1,404	3,295
Number of SKU-Month Obs.	633,742	103,891	141,887
Total Consumer Spend (8/16/16-5/31/22)	[redacted]		
Weighted Average Pass-Through Rate		**3.0%**	

Source: See Exhibit 5.

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[41] Robbins, M. W., Saunders, J., Kilmer, B. (2017). A Framework for Synthetic Control Methods With High-Dimensional, Micro-Level Data: Evaluating a Neighborhood-Specific Crime Intervention, Journal of the American Statistical Association (517), 109–126; Abadie, Alberto. 2021. "Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects," Journal of Economic Literature, 59 (2): 391-425.

52. To the extent Plaintiffs' experts attempt to explain the finding of small service fee pass-through by arguing that that the developers who received the service fee reductions from Google or their customers were not "price-sensitive," they would be incorrect because the pass-through rate is not determined solely by "price-sensitivity."[42] For example, in Dr. Rysman's model, the service fee pass-through rate is always 100%, regardless of the price-sensitivity of demand. Moreover, there is no evidence to support the claim that the price-sensitivity of demand for the paid downloads, IAPs, and subscriptions receiving the discount was greater than the price-sensitivity of demand for the paid downloads, IAPs, and subscriptions that did not receive the discount.

53. Dr. Singer argues that price stickiness, "which arises due to well-understood behavioral economic phenomena such as consumer anchoring, tend to limit pass-through in the actual world, …"[43]. Therefore, to the extent Dr. Singer and Plaintiffs' other experts attempt to explain the finding of small service fee pass-through by arguing that there is price stickiness that prevented price changes within the time frame I have analyzed, this argument fails to recognize that any such price stickiness also would be present in the but-for world and would prevent the pass-through of a lower but-for service fee. In other words, price stickiness is an important real world phenomenon; it does not undermine my econometric results; rather, it undermines Plaintiffs' experts' damages calculations that entirely ignore price stickiness and therefore overstate pass-

[42] The marginal cost pass-through rate may not depend at all upon price-sensitivity of demand. For example, with linear demand, the pass-through rate of a marginal cost change is 50% regardless of the price-sensitivity. Dr. Singer recognizes this as well, see Singer Class Rebuttal Report ¶ 74 ("For example, as pointed out in the Singer Report, whenever the demand curve is assumed to be linear, the pass-through rate is always exactly 50 percent, regardless of how steep or flat the curve is.") and Singer Report ¶ 336 ("For example, with a linear demand curve (a downward sloping straight line), even in monopolistic markets, at least half of marginal cost savings are passed through to customers.")

[43] Singer Report ¶ 370.

through. In addition, as discussed above, small service fee pass-through can be the result of a number of factors, including the shape of the demand curve and a low level of marginal cost. These factors would operate to limit pass-through in the short run and the long run. Thus, any claim by Plaintiffs' experts that pass-through would be greater in the "long run" than I found in my analysis would require that they demonstrate that price stickiness is the only or primary cause of the small pass-through that I found. Even then, they would have to define empirically the "long run" in this context. If the "long run" were, say, years, price stickiness could limit service fee pass-through in Plaintiffs' experts' but-for worlds for a significant portion of the damages period. I note that while insisting that price stickiness limits pass-through in the short run, Dr. Singer neverthess in his Class Rebuttal Report argues that "the basic economic logic of pass-through applies both to short-run and long-run profit maximization. *In the short run, positive marginal costs are sufficient to generate pass-through given a change in the take rate*."[44] [Emphasis added]

54. To the extent that Plaintiffs' experts attempt to argue that the small service fee pass-through I found was due to the apps that did not receive the service fee reductions lowering their prices anyway, perhaps due to competition with the apps that did receive the service fee reduction, this argument is both inconsistent with Plaintiffs' experts' assumptions regarding app demand and is unsupported empirically. In Dr. Rysman's model, an app will exhibit 100% service fee pass-through even if it is the only app receiving the reduction in service fee; conversely, in his model, an app will not lower its price if it did not receive a service fee reduction, even if other apps did. See Appendix E for a proof of this result. Similarly, with the logit demand model used by Dr. Singer, an app receiving a service fee reduction will exhibit pass-through, but apps not receiving

[44] Singer Class Rebuttal Report ¶ 31.

a service fee reduction exhibit minimal price changes. Thus, under either of Plaintiffs' experts' models of demand, apps receiving a service fee reduction would have a markedly different price response than even competing apps that did not receive the service fee reduction. Accordingly, the latter group is an appropriate control for the former group under Plaintiffs' experts' own assumptions regarding app demand. However, I also empirically investigated this issue by running the analysis on the subset of transactions associated with apps in categories where the apps receiving the reduced service fees made up only a relatively small percentage of the category's transactions. While the apps receiving the reduced service fee would still have an incentive to reduce their prices (subject to the other conditions necessary for positive pass-through), other apps in the category would not because the former group would not have a strong competitive effect on the latter group. I find the same small service fee pass-through rate for this subset of the data.[45]

VI. Consumers – Dr. Singer's Damages Calculations

A. Overview of Dr. Singer's Damages Calculations

55. Dr. Singer calculates consumer damages based on alleged (service fee) overcharges, consumer subsidies, and a combination of overcharges and consumer subsidies, and uses several different approaches in doing so. In all, he has six calculations.

56. The first calculation is an overcharge calculation for Dr. Singer's "app distribution" market, i.e., paid app downloads, which Dr. Singer refers to as the "Android app distribution market model" (hereafter "Singer app distribution market model").[46] Dr. Singer uses a theoretical two-sided platform model based on Rochet and Tirole (2003) to predict Google's but-for service

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[45] See Appendix C.

[46] Singer Report ¶ 288.

fee rate for paid downloads.[47] Using this but-for service fee rate and an assumption regarding the pass-through rate, he calculates the overcharges paid by consumers on paid downloads. In this calculation, he assumes that the consumer subsidies, as a percentage of the app price, would have been the same in the but-for world as in the actual world.[48]

57. The second calculation is an overcharge calculation for his IAP market, which Dr. Singer refers to as the "In-App Aftermarket model" (hereafter "Singer IAP model").[49] Here, Dr. Singer uses a one-sided theoretical model to predict Google's but-for per-unit service fee for IAPs. Using this but-for per-unit service fee and an assumption regarding the pass-through rate, he calculates overcharges paid by consumers on IAPs. In this calculation, he again assumes that consumer subsidies, as a percentage of the app price, would have been the same in the but-for world as in the actual world.

58. For the third calculation, Dr. Singer combines downloads and IAP and treats them together, which he refers to as the "single market take rate model" (hereafter "Singer combined market take rate model")[50] He again uses a theoretical two-sided platform model based on Rochet and Tirole (2003) to predict Google's but-for service fee rate for paid downloads and IAPs. Using this but-for service fee rate and an assumption regarding the pass-through rate, he calculates overcharges paid by consumers on paid downloads and IAPs. In this calculation, he again assumes that the

[47] Jean-Charles Rochet & Jean Tirole, "Platform Competition in Two-Sided Markets," 1(4) European Economic Association 990 (2003) (hereafter "Rochet and Tirole (2003)").

[48] Singer Report ¶ 304.

[49] Singer Report ¶ 330. Dr. Singer provides an estimate of U.S. Consumers' aggregate damages as the summation of his damage estimates from his app distribution market and in-app aftermarket. See Singer Report Table 18. I hereafter refer to this as the "Singer app/in-app model."

[50] Singer Report ¶ 441.

consumer subsidies, as a percentage of the app price, would have been the same in the but-for world as in the actual world.

59. For the fourth calculation, Dr. Singer again combines paid downloads and IAPs and applies the theoretical two-sided platform model, which he refers to as the "discount model" (hereafter "Singer combined market discount model").[51] However, for this calculation, he assumes that the service fee rate would have been the same in the but-for world as in the actual world and instead uses the model to predict the but-for consumer subsidy level. He then calculates damages based on the difference between the amount of consumer subsidy in the but-for and actual worlds.

60. For the fifth calculation, Dr. Singer uses the same theoretical model for paid downloads and IAPs to predict both the service fee rate and the consumer subsidy level in the but-for world, which he refers to as the "single market hybrid model" (hereafter "Singer combined market hybrid model").[52] That is, he allows for the possibility that both could have changed in the but-for world. Damages are the sum of the service fee rate overcharges passed through to consumers and the subsidy reduction in the actual world versus the but-for world. Thus, this calculation is a hybrid overcharge/consumer subsidy calculation.

61. For the sixth calculation, Dr. Singer calculates damages under the assumption that, in the but-for world, Google would have paid out consumer subsidies in the same percentage of revenue as Amazon has paid out in the Amazon App store on third party devices, which he refers to as the

[51] Singer Report ¶ 384.

[52] Singer Report ¶ 441.

"Singer Amazon discount model."[53] Dr. Singer's sixth calculation is a purely consumer subsidy calculation.

B. Dr. Singer's Overcharge Damages Calculations

62. As noted above, Dr. Singer's first three calculations focus on service fee overcharges and involve (1) using a theoretical model to determine the but-for service fee rate and then (2) applying an assumed pass-through rate to determine the amount of the service fee rate overcharge that consumers paid. Each of these three calculations is flawed because the assumed pass-through rate is unsupported and, in fact, inconsistent with the empirical evidence and the theoretical model used to determine the but-for service fee rate is based on inappropriate assumptions.

1. Dr. Singer's Pass-Through Rate Formula Is Erroneously Based on the Formula for the Per-Unit Cost Rather Than for the *Ad Valorm* Cost

63. Dr. Singer's pass-through rate is based on his assumed logit demand model, which is unsupported and flawed, as discussed below. But even taking his logit demand model as given, as a fundamental matter, Dr. Singer fails to account for the differences between the pass-through of a service fee rate (assessed as a percentage of revenue) and the pass-through of a traditional marginal cost and erroneously uses a pass-through rate formula based on the per-unit cost. He cited one of my publications multiple times to support cost pass-through without understanding that I was discussing per unit marginal cost instead of the pertinent *ad valorem* cost.[54] In his Class Rebuttal Report, Dr. Singer further confuses the service fee pass-through and its relationship with per unit marginal cost when he defends his high pass-through rate by arguing that service fee itself

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[53] Singer Report ¶ 420.

[54] Singer Report fn. 790 and 791, citing Jerry Hausman & Greg Leonard, Efficiencies from the Consumer Viewpoint, 17(3) GEORGE MASON LAW REVIEW 707, 709 (1999).

is a marginal cost (hence there should be pass-through): "the take rate [service fee rate] itself represents a marginal cost that applies to the initial App purchase and any purchase of In-App Content."[55]

64. Correcting this mistake alone, even if retaining his logit demand model, shows that the pass-through rate depends on developer's marginal cost, and as discussed above, the pass-through rate for a given change in a service fee rate will decrease with marginal cost.[56] That is, all else equal, if a firm's marginal cost per unit of output is lower, its pass-through rate for a service fee rate change will be smaller.[57]

2. Dr. Singer's Pass-Through Rate Estimate is Effectively an Assumption, Is Unsupported, and Is Inconsistent with the Empirical Evidence

65. For Dr. Singer's calculations focusing on service fee overcharges, his theoretical models produce a measure of the overcharge that app developers supposedly paid on the Google Play service fee rate, but consumers were damaged only to the extent that the app developers passed at least part of the service fee overcharge through to consumers in the form of higher paid download, IAP, or subscription prices. As discussed above, the pass-through rate for a given firm (here, an app developer) depends on the shape of the demand curves faced by the firm and its competitors, the nature of competition, and other marketplace factors and thus is ultimately an empirical issue. Rather than undertaking an empirical analysis designed to measure the pass-through rate for app developers, Dr. Singer effectively assumes a pass-through rate. This is because *he assumes a*

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[55] Singer Class Rebuttal Report ¶ 21.

[56] See Appendix D for details.

[57] As with many aspects of pass-through, this property depends on the shape of the demand curves. For a specific type of demand curve shape (constant elasticity, as those assumed by Dr. Singer in some of his damages models), the pass-through rate for a service fee rate change does not change with marginal cost.

particular shape for the demand curves faced by app developers. The pass-through rate is essentially dictated given this assumption because, as noted above, the pass-through rate depends on the shape of the demand curve.

66. I have discussed above why Dr. Singer's formula is wrong even taking his logit demand as given, because it is not based on the *ad valorem*-type service fee at issue. However, there are other ways to see why Dr. Singer's pass-through formula is flawed. Under his assumption (and holding the elasticity of demand constant), Dr. Singer's formula shows that a firm's pass-through rate is determined only by its share of unit sales in a given app category and is inversely related to the unit share.[58] . But because most individual developers have small shares of Android downloads, IAPs, or subscriptions within each app category as defined in Google Play's transactions data, and Dr. Singer (incorrectly) assumes that all apps in each app category are in the same broad "market," Dr. Singer's pass-through rates for individual developers will be near 100% merely as a consequence of Dr. Singer's assumption of the logit demand.[59] This makes no economic sense and does not comport to the economic reality. Dr. Singer tries to defend his use of these broad app-cateogry-based markets. For example, Dr. Singer argues that the "Play Store's categories make economic sense because they reflect economically reasonable groupings of consumer tastes for different varieties of Apps, as recognized by a range of industry participants, including

[58] As Dr. Singer explains, "what the logit demand system does imply is that developers in a given category pass through cost savings according to their dominance (or lack thereof) in the category, as measured by their market share within that category." Singer Report ¶ 351.

[59] Dr. Singer also gives reasons why he believes there should not be any meaningful "classification error" because the categories are self-selected by the developers, see Singer Report ¶ 350 ("Developers, who presumably know their customers best, use Google's categories to sell their Apps in competition with other developers; they have clear incentives to select a meaningful category to maximize the value of their Apps.") While a developer may want to assign its app to the most relevant category, there may still be ambiguity as to which category is in fact the most relevant, given how broad these categories are. I discuss this point further below.

Google."[60] He specifically noted that these App cateogries have been used by Google and industry analysts in consumer research. But the fact that these categories are used by Google and analysts does not justify their validity or relevance for informing the specific economic question of service rate pass-through. Some examples will make clear why Dr. Singer's method leads to non-sensical results. Consider the category Education. This category includes "exam preparations, study-aids, vocabulary, educational games, language learning" and more.[61] It is clear how broad this category is and why using it would significantly inflate Dr. Singer's pass-through rates. According to the transaction data that Dr. Singer used to calculate the shares and pass-through rates, Rosetta Stone, a major developer of language learning apps, is in the same Education category along with an app that identifies plants (PictureThis - Plant Identifier), an app of kids books (Epic: Kids' Books & Reading), and a communication app for teachers, parents, and students (ClassDojo). As a result, Dr. Singer's pass-through rate for Rosetta Stone would depend on a "market" that includes all types of exam preparation, study-aids, children's books, educational games, all regardless of the subject matter or the price level.[62] This makes little economic sense. Consider next the category Business. This category includes "document editor/reader, package tracking, remote desktop, email management, job search."[63] Consequently, a business accounting app such as QuickBooks Online Accounting is in the same "market" as Thumbtack, an app for home improvement service business, Sideline, an app for adding a second phone number, and even Linkedin, a professional

[60] Singer Report ¶ 349.

[61] "Choose a Category and Tags For Your App or Game," Play Console Help, https://support.google.com/googleplay/android-developer/answer/9859673 .

[62] The latter implies that Dr. Singer treats an app priced at $0.99 exactly the same as another app priced at $199.

[63] "Choose a Category and Tags For Your App or Game," Play Console Help, https://support.google.com/googleplay/android-developer/answer/9859673.

network app. The same issue applies to most of the App categories Dr. Singer uses.[64, 65] Another way to see why these App categories are overly broad is to recognize that in the transaction data that Dr. Singer used to calculate the shares, Google Play store has 482,893 paid apps but only 33 App categories and as Dr. Singer noted "[m]ore than 99 percent of the Apps are assigned to just one category."[66] The combination of a large number of apps, a small number of categories, and the overwhelming fraction of the apps being assigned to a single category has two implications. First, many categories will have to rather encompassing, consistent with what I showed above. Second, some apps that may very well fit in multiple categories were put in only one of the categories. Dr. Singer's pass-through rate for a developer can be drastically different when an app is moved into another sensible category. In fact, Dr. Singer considered putting Tinder in both the Lifestyle category and the Dating category and estimated a pass-through rate of 65.5% for the former and 81.4% for the latter. Dr. Singer does not assess any alternative categories for other Apps.[67] Finally, the developer of the paid app [redacted] offers two apps in the music

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[64] For further examples, consider the category Tools, which includes "tools for Android devices," and the category Finance, which includes banking, payment, ATM finders, financial news, insurance, taxes, portfolio/trading, tip calculators. "Choose a Category and Tags For Your App or Game," Play Console Help, https://support.google.com/googleplay/android-developer/answer/9859673. Dr. Singer attempted a sensitivity analysis where he used subcategories of the Game category and reported a 14.7 percentage points reduction in his estimated pass-through rate for the game category.

[65] In his Class Rebuttal Report, Dr. Singer also argues that his approach "yields the economically intuitive result that developers with a lower market share (and thus less pricing power) will be inclined to pass through a larger proportion of a given cost decrease to consumers." This qualitative argument misses the point as Dr. Singer would obtain the same qualitative finding no matter how he defines the App market, as long as he uses the logit demand form and his incorrect pass-through formula. Singer Class Rebuttal Report ¶ 73.

[66] Singer Report ¶ 349.

[67] Instead, Dr. Singer argues that "although there is no requirement that the market share for the logit demand model be computed in a relevant antitrust market, it bears noting that antitrust has recognized 'cluster markets,' in which the market is comprised of items that are not always substitutes." Singer Report ¶ 352. Therefore, Dr. Singer appears to concede that his app category-based "markets" may very well contain apps that are not substitutes for each other. But more fundamentally, a logit model like the one that Dr. Singer used *assumes* that the products over which shares are calculated are substitutes for each other and, even more, that the cross price elasticities of demand are the *same* for all products (with respect to a given product's price). Thus, the logit

and audio category and has an average unit share of 7% of the category.[68] Dr. Singer's approach predicts this developer will have a pass-through of 93% based on its average unit share of 7% in the category. Yet, contrary to Dr. Singer's prediction, the prices of the paid apps (and IAPs) of this developer did not change after the service fee rate change in July 2021. This demonstrates how Dr. Singer's approach to pass-through rates is inconsistent with the empirical evidence.

67. Assuming a different demand curve shape would have implied a different pass-through rate. For example, a firm with the same elasticity of demand and same market share, but facing a linear demand curve rather than a logit demand curve, can have a substantially different pass-through rate. Had Dr. Singer assumed a different demand curve shape, he would have obtained a different pass-through rate and thus different damages calculations.

68. Dr. Singer could have either empirically demonstrated that the actual demand curves faced by app developers have the shape that he assumed or he could have performed a direct econometric estimation of the pass-through rate using procedures flexible enough to be valid regardless of the shape of the demand curves. He did neither and thus his pass-through rate assumption is unsupported. While Dr. Singer estimates a logit demand function on app data, this assumes, rather than demonstrates, that the logit functional form is the appropriate demand functional form to use in this context. To make such a demonstration, Dr. Singer would have had to, for example, compare the logit model to alternative demand functional forms to assess which provided a better fit to the app data. Dr. Singer's justification for his logit model appears to be that it "fits the data

model is not appropriate for modeling a "cluster market." Accordingly, Dr. Singer's approach can lead to non-sensical results.

[68] The app [redacted] also offers IAPs, whose prices stayed the same after the service fee rate decreased from 30% to 15% after July 1, 2021. This developer also offered another paid app "[redacted]" in the music and audio category during February 2015 and November 2016, whose prices stayed flat during this period as well.

well for the Play Store's various App categories: price coefficients have the expected (negative) sign and are highly statistically significant"[69] and that it "explain[s] approximately 95 percent of the variation in category shares."[70] However, as a matter of generally accepted econometric methods, this is not a valid justification for his use of the logit model. As a logical matter, because he did not compare the logit model to any alternative demand functional forms to assess which provides a better fit and whether the logit model is the only demand model that produces what he claims are the expected sign and statistical significance, he has no empirical basis by which to claim that the logit model is the one to use.

69. But the most fundamental issue with Dr. Singer's justification is that it violates basic statistical principles. Consider Dr. Singer's justification based on how much data variation the logit demand model explains. First, the variation he referred to is the variation in his "dependent variable," developer category shares, which is dictated by his assumption of demand functional form. Therefore, being able to explain the variation of a variable which itself is an implication of his assumption cannot be used to defend his assumption. Had he considered different demand shapes that imply a different dependent variable, then the percentage of variation explained, commonly known as a regression R-squared (R^2), would not even be comparable. This is a well-known statistical principle.[71]

70. Furthermore, even if the dependent variable is the same, statisticians and econometricians have cautioned against the use of percentage of explained variation for choosing among model

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[69] Singer Class Rebuttal Report ¶ 70.

[70] Singer Report ¶ 354.

[71] See, for example, Peter Kennedy, A Guide to Econometrics, 6th Edition, 2011, p 103 ("... if the dependent variables are not the same, the R^2 is not directly comparable.").

specifications. In fact, one can always increase the R-squared by putting more explanatory variables into the statistical model and/or by making the model more flexible, irrespective of whether the additional factors or model flexibility reflect the true underlying relationship.[72] Using the percentage of variation explained can lead to the statistical issue of overfitting. For example, in the context of choosing flexible statistical models, econometrician Peter Kennedy explains that one needs to be careful to avoid "the very real danger of overfitting," which is when the model matches the data so well that it "reflects peculiarities of this dataset rather than the general underlying specification."[73]

71. Nor is statistical significance of the explanatory variables a valid justification for the demand functional form. Dr. Singer's own actions demonstrate that he understands this. His OLS regressions also give statistical significance (and his expected signs) and yet he did not stop there. He also uses "'IV' regressions to correct for endogeneity."[74] Clearly, he recognizes that "correct" signs and statistical significance do not, by themselves, mean that the underlying estimates are valid.

72. Dr. Singer also tries to justify his logit demand form by arguing that it is "standard."[75] He cites to some literature to support this justification. While the logit demand form has been used in economics historically, economists have uncovered a number of serious limitations in the simple logit model used here by Dr. Singer to the point where today it is uncommon for an empirical

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[72] See, for example, James Stock and Mark Watson, Introduction to Econometrics, 6th edition, 2014, p. 197 and Jeffrey Wooldridge, Introductory Econometrics, 2016, p. 180.

[73] Peter Kennedy, A Guide to Econometrics, 6th Edition, 2011, p. 357.

[74] Singer Report ¶ 353.

[75] See Singer Class Rebuttal Report ¶ 70 and also ¶ 74 (arguing that one should not fault the simple pass-through formula based on logit demand).

economics research study to use this model, at least without substantial testing of whether its limitations are restrictive in the context where it is being used.[76] Thus, "it has been used in the past" is not a valid justification for Dr. Singer's use of the logit model here, particularly given the substantial sensitivity Dr. Singer's damages calculations have to this choice. In fact, Eeconomists have concluded that the logit model is highly restrictive and therefore not a good modeling choice in many contexts.

73. The only support for his pass-through rate assumption that Dr. Singer identifies are two observations about pricing in the marketplace.[77] First, he notes that subscriptions for six particular apps (Tinder, BookedIn, Down Dog, Spotify, Tidal, and YouTube) are priced differently on their websites than within their respective Android apps. Based on the price differences between the website and within-app, Dr. Singer computes "implied pass-through rate[s] [sic]," which he claims

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[76] The logit model (and the CES demand model used by Dr. Rsyman) exhibits what is called the "independence of irrelevant alternatives" (IIA) property. The IIA property places strong restrictions on substitution patterns between products (i.e., the own- and cross-price elasticities of demand). Because of IIA's restrictiveness regarding substitution patterns, from the early 1980s, the economics literature has warned about the use of the logit model of demand. See, e.g., D. McFadden, "Econometric Models of Probabilistic Choice," in *Structural Analysis of Discrete Data with Econometric Applications*, 1981, pp. 222-223 ("…models satisfying [IIA] yield implausible conclusions when there are strong contrasts in the similarity of the alternatives"); S. Berry, "Estimating Discrete Choice Models of Product Differentiation," *RAND Journal of Economics*, 1994, p. 250 ("[t]he logit model products unreasonable substitution patterns"); J. Hausman and G. Leonard, "Economic Analysis of Differentiated Products Mergers Using Real World Data," *George Mason Law Review*, 1997, p. 322 ("…the [IIA] assumption…implicitly restricts the demand structure by constraining the pattern of demand substitution between products"); D. Brownstone and K. Train, "Forecasting New Product Penetration with Flexible Substitution Patterns," *Journal of Econometrics*, 1999, p. 110 ("…identification of the correct substitution patterns is an empirical issue, and the IIA property…imposes a particular substitution pattern rather than allowing the data analysis to find and reflect whatever substitution pattern actually occurs"); A. Nevo, "Mergers with Differentiated Products: The Case of the Ready-to-Eat Cereal Industry," *RAND Journal of Economics*, 2000, p. 402 ("the logit model greatly restricts the own- and cross-price elasiticities"); P. Davis and E. Garces, *Quantitative Techniques for Competition and Antitrust Analysis*, 2010, pp. 477-478 ("…the logit model imposes severe limitations on own- and cross-price elasticities…we recommend strongly against using [logit] models in situations where we must learn something about substitution patterns…"). As a consequence, economists have developed less restrictive demand systems (e.g., S. Berry, et al., "Automobile Prices in Market Equilibrium," Econometrica, 63 (1995), pp. 841-890) and these systems are the most commonly used in empirical economics research today.

[77] Singer Report §VI.D.4.V.

range from 33% to 105%.[78] He concludes that this range supports his 91.1% assumed pass-through rate for all Android apps.

74. However, Dr. Singer's website versus within-app price comparison using these six apps is a flawed method by which to derive a pass-through rate that would then be assumed to apply to all Android apps for several reasons.

75. First, Dr. Singer cherry-picked the six examples and ignored that there are many other cases where the website price is the same as the within-app price. For example, the Minecraft game is listed at the same price on Google Play and on the developer's website.[79] A subscription to iHeartMedia has the same retail price on Google Play and the website.[80] A subscription to Pandora Plus has the same retail price on Google Play and the website.[81] In fact, Tinder charges the same price in-app, regardless of whether a consumer pays using Google Play Billing or Tinder's own billing system.[82] Pure Sweat Basketball (PSB), one of the named developer class representsatives, even lowered its monthly subscription price from $9.99 to $4.99 and annual price from $99.99 to $49.99 when it moved its subscription service from its website to Google Play store.[83] In his Class Rebuttal Report, Dr. Singer tried to dismiss examples of apps that charge the same prices on websites and in app. In his view, the pricing of those apps is uninformative about pass-through

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78 Singer Report Table 14.

79 The Minecraft app's price is $7.49 for Android mobile version on the developer's website https://www.minecraft.net/en-us/store/minecraft-android,, as well as in the Google Play store, https://play.google.com/store/apps/details?id=com.mojang.minecraftpe.

80 https://www.iheart.com/offers/, accessed November 4, 2022. Google Play store price accessed with an Android device as of November 4, 2022.

81 https://www.pandora.com/plans, accessed November 4, 2022. Google Play store price accessed with an Android device as of November 4, 2022.

82 See screenshots from Tinder mobile application downloaded from Google Play.

83 Czeslawski Deposition, p. 285: 5-24.

because Google's "anti-steering restrictions … explicitly prevent developers from directing customers inside the Play Store to lower-cost options outside the Play Store. An App that charges the same price within the Play Store and on its website has simply not adopted a steering strategy in the actual world."[84] Note that Dr. Singer is not denying the fact that a developer is free to set different prices in app and on websites; he also acknowledges that some apps do charge the same prices. Instead, he claims that only the evidence that supports his conclusion is relevant and informative. When the evidence does not support his conclusion of high pass-through, he argues that that is simply because the developers have not done it yet; however, this is pure speculation for which he provides no actual evidence. This is another example where Dr. Singer assumes his conclusions.

76. Second, the six apps Dr. Singer chose to examine do not constitute a representative sample of all Android apps. Three of the six apps, Spotify, Tidal, and YouTube, are music and video streaming apps. Such apps have significant marginal costs, as they are obligated to pay royalties to content providers such as record labels and music publishers. In contrast, many other types of apps do not require the payment of royalties and, indeed, as discussed elsewhere in this report the marginal cost for many other types of apps would be expected to low. As explained above, the pass-through rate for a service fee can vary with marginal cost. Thus, apps with high marginal costs like certain streaming apps will not be representative of those apps that have low marginal costs for the purposes of determining the service fee pass-through rate.[85] No valid conclusions for the large majority of Android apps can be made based on music and video streaming apps. Like

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84 Singer Class Rebuttal Report ¶ 80.

85 Even for streaming apps, such as music streaming apps, some copyright royalties are *ad valorem*.

the streaming apps, Down Dog, a yoga and exercise app, also likely has significant marginal costs due to having to pay fees to instructors when new members sign up.

77. Third, Dr. Singer's implicit assumption that the *entire* difference between the website price and the within-app price for these six apps is due to the service fee rate that is paid on the latter is invalid. Basic economics teaches that prices are determined by both supply and demand. Price differences, therefore, could be caused by differences in supply factors (e.g., costs, service fee rate, complementarities between products, etc.) demand factors (e.g., the characteristics and options of consumers who purchase, respectively, on the website or in-app), or both. Attributing the entire price difference to the difference in service fee alone, as Dr. Singer did, is incorrect, unless Dr. Singer could establish that none of the other economic factors differ between the website and in-app. Dr. Singer made no effort to show that the price differences are driven entirely by the single supply-side factor he identified–the service fee rate–and not driven at all by any other supply-side factors (costs, complementarities between products, etc.) or demand-side factors (e.g., the characteristics and options of consumers who purchase, respectively, on the website or in-app).

78. In fact, there are good reasons to believe that other economic factors could contribute to the price difference. On the supply side, the lower price on an app's website may due to other strategic considerations. For example, Epic reduced the price of V-Bucks as part of its Project Liberty project, even though its internal analysis had predicted that such a price reduction would not be profitable.[86] It could also be the case that developers may not consider their costs and app

[86] See EPIC_GOOGLE_03979041. The Court's decision in *Epic v. Apple* states that "Project Liberty included a public narrative and marketing plan" and cites Epic's own characterization of the price drop of V-Bucks as a public relationship strategy: "Project Liberty included a public narrative and marketing plan. Epic Games recognized that it was 'not sympathetic' and that if Apple and Google blocked consumers from accessing the app, '[s]entiment will trend negative towards Epic." "[T]he critical dependency on going live with our VBUCKS

store service fee payments when setting prices. For example, Pure Sweat Basketball confirmed that they did not reduce prices as a result of Google's service fee rate reduction.[87] Rescue Pets also indicated that they did not lower prices in response to Google Play's service fee reduction.[88] LittleHoots did not consider service fees charged by Apple or Google when setting subscription prices.[89]

79. Again, Dr. Singer's assumption that any price difference between the website and in-app is entirely due to the Google Play service fee, and not at all due to any other supply or demand factor is untenable. Another way to frame the issue is that Dr. Singer's approach suffers the well-known omitted variable bias. My empirical analysis of pass-through, as discussed above, shows that bias in Dr. Singer's approach is substantial. In contrast to Dr. Singer's assumed 91.1% pass-through rate, I find a pass-through rate of no more than 3%.

80. Dr. Singer then argues that "Google's take rate is economically analogous to a tax on developers. Elementary economics shows that changes in tax rates shift prices, including the prices paid by consumers for goods or services subject to sales taxes. … When a digital product is subject to a tax, this burden is typically passed through in full to the customer; it is not absorbed by the seller."[90] As a piece of supporting evidence, Dr. Singer estimates a regression model where

price reduction efforts is finding the most effective way to get Apple and Google to reconsider without us looking like the baddies.'" *Epic Games, Inc. v. Apple Inc.*, Rule 52 Order After Trial On The Merits, NO. 4:20-CV-05640-YGR (N.D. CAL.).

87 Deposition of Richard Czeslawski (Mar. 21, 2022) ("Czeslawski Dep."), at 315: 17-318: 7.

88 Deposition of Daniel Scalise (Mar. 11, 2022) ("Scalise Dep."), at 214: 17-24, 215: 15-19.

89 Deposition of Lacey Ellis (Mar. 22, 2022) ("Ellis Dep."), at 256: 9-22.

90 Singer Report ¶ 367.

he essentially correlates post-tax prices and the tax rates across states and time and claims that the estimated coefficient on the tax rate implies 100% pass-through.[91]

81. However, Dr. Singer's arguments are flawed, and his regression analysis is uninformative about the pass-through of service fees. First, while the service fees are levied directly on the developers, sales taxes are levied directly on consumers. Therefore, for Dr. Singer's argument that it is the developers' *decision* to pass on the full amount of taxes to make sense, it must be the case that developers have the *ability* to adjust *pre-tax* prices in response to tax rate variation as a way to absorb taxes, but *choose* not to. If developers do not have the ability to adjust pre-tax prices in response to tax rate variation, or otherwise choose prices independently of tax rates, Dr. Singer cannot equate the changes in prices due to taxes to the changes in prices due to service fees. Google Play, as Dr. Singer noted, offers the service of calculating appropriate taxes and automatically applies the calculated amount to the final price that a consumer pays in the US.[92] I understand that Google's system does not allow developers to systematically set different pre-tax prices for different states in the US.[93] However, tax variation across states is the only source of cross-sectional variation that Dr. Singer considered in his regression model. Indeed, for most developers, given the global nature of the Google Play store, having to deal with the complexity and intricacies of state and local tax laws and needing to figure out the appropriate amount of taxes

91 Singer Report ¶ 368.

92 Singer Report, fn. 873. See also Tax rates and value-added tax (VAT) – Play Console Help, support.google.com/googleplay/android-developer/answer/138000?hl=en ("In accordance with sales tax requirements, Google is responsible for determining, charging, and remitting sales tax for Google Play Store App and in-App purchases by customers in these states. Google will collect and remit sales tax to the appropriate tax authority, as applicable. You don't need to calculate and send sales tax separately for customers in these states. Even if you're not located in the United States, this treatment will still apply.")

93 Developers can only set the pre-tax list price at country/region level. See, "Set Up Your App's Prices," Play Console Help, https://support.google.com/googleplay/android-developer/answer/6334373?hl=en#zippy=%2Cpaid-apps%2Cin-app-items%2Csubscriptions, accessed Oct 28, 2022.

to charge would be costly, even if they *could* set different prices. In short, because developers do not have the ability to change different pre-tax prices in response to different tax rates across states at a given point in time, Dr. Singer has no basis to claim that his tax regression is informative about developers' *decision* to pass on taxes.

82. Thus, Dr. Singer's regression of post-tax prices on tax rates is also uninformative about service fee pass-through. His regression coefficient for the tax rate is approximately 0.01, which Dr. Singer interprets as a 100% tax pass-through. He explains in a footnote, "suppose that the price of an App is initially \$2.00. The regression predicts that, if the tax rate increases by one percentage point, the [post-tax] price that the consumer pays for the App will increase by approximately 1.1 percent, from \$2.00 to \$2.02."[94] However, when the pre-tax prices for individual transactions are set independently from taxes, so that by definition there is zero pass-through, Dr. Singer's regression is *mathematically guaranteed* to produce his finding of a positive and nontrivial coefficient on the tax rate that is close to 0.01. To see this, note that his dependent variable can be written as $\log(P^{pretax} + tax)$. Using a well-known mathematical approximation,[95] it is easy to show that Dr. Singer's post-tax price is approximately equal to $\log(P^{pretax}) + tax\ rate$, where $tax\ rate = \frac{tax}{P^{pretax}}$. Note also that Dr. Singer's tax variable is equal to multiplied by 100. Basic regression theory tells us that the regression coefficient on this tax variable will have to be close to $\frac{1}{100} = 0.01$. In other words, Dr. Singer's regression essentially correlates tax rate with itself and the 0.01 coefficient is a simple result of the fact that he scaled the tax rate, his independent variable, by 100. Therefore, Dr. Singer's dependent and independent

94 Singer Report fn. 876.

95 This is known as a "Taylor expansion." See, for example, Theorem 30.6 of C. Simon and L. Blume, *Mathematics for Economists*, 1994, p. 829.

variables would be guaranteed to be correlated and result in a coefficient close to 0.01, even if developers do not take tax rates into account when choosing their pre-tax prices. That is, Dr. Singer would have gotten the same result whether or not developers take into account tax rates when setting pre-tax prices. Consequently, Dr. Singer's regressions cannot even provide any economically meaningful information about pass-on of taxes, much less the pass-on of a service fee.[96]

83. Dr. Singer then argues that one cannot rely on the empirical analysis of actual rate changes to infer pass-through. He offers two reasons. One has to do with his claim that that price stickiness, "which arises due to well-understood behavioral economic phenomena such as consumer anchoring, tend to limit pass-through in the actual world, …."[97] I have addressed this point and explained why this is not a valid argument above. Therefore, I focus on Dr. Singer's second argument. Dr. Singer claims that in "the but-for world with more than one App store or payment processor, developers would be incentivized to pass on savings from a lower take rate via steering and discounting, to induce consumers to switch to the low-cost provider… These incentives are absent in the actual world. Developers that enjoyed Google's limited take-rate decreases in the actual world did not have to share any of the savings with their customers in order to realize the cost savings." Dr. Singer's claim that being able to steer consumers is the main or even the *only* reason developers pass on cost savings is wrong as a matter of basic economics and is directly contradicted by his own models and calculations. Nowhere in any of his theoretical models does he incorporate steering by developers, yet he has built pass-through into the models regardless.

[96] In his implementation of the regression models, Dr. Singer also made a mistake when he constructed his post-tax prices. Dr. Singer mistakenly divided the unit tax by the quantity sold. This means that the taxes included in his post-tax prices are artificially deflated.

[97] Singer Report ¶ 370. Internal citations omitted.

Moreover, the logit-based pass-through formula Dr. Singer used to infer his high pass-through rates does not reflect or depend on steering whatsoever. Dr. Rysman's assumed model, which I respond to in detail in the next section, also does not incorporate steering and yet implies 100% pass-through. In other words, while Dr. Rysman does not provide any empirical support for his assumed 100% pass-through rate, his model nevertheless shows that pass-through may exist absent "steering," contrary to Dr. Singer's claim. In addition, even as a theoretical matter, Dr. Singer cannot assume that Google would be necessarily induced to lower prices simply due to developers' potential steering in the but-for world. Branded drug pricing after generic entry is a prominent example where entry does not necessarily result in lower prices for incumbents, even in the presence of steering.[98] The explanation is that generic drugs may attract "price-sensitive" consumers, i.e., those with high price elasticity, which in turn implies that those who continue to use branded drugs are less price sensitive. A rational branded drug producer may therefore choose to maintain or even raise its price after generic entry. Google may face similar incentives in the but-for world--price-sensitive consumers could switch to other stores, leaving less price-sensitive consumers ("single homers") on Play. Accordingly, Google may have chosen to maintain its service fee rather than respond to the entry of other app stores.[99] Dr. Singer claims but never analyzes the number or identity of any app stores entering in the but-for world, so his speculation about steering and its effects is just that. In addition, if developers have a strong incentive to steer consumers, as Dr. Singer claims, developers prevented from steering within the Google Play store

[98] D. Lakdawalla, "Economics of the Pharmaceutical Industry," *Journal of Economics Literature*, 56 (2018). Pharmacies often have the economic incentive to steer patients toward generic versions of a drug given that they receive larger profit margins on generic than branded drugs.

[99] In Section VIII, I discuss in more detail the economic reasons why consumers may single-home and why Google could maintain its service fee rate in the but-for world, in the context of higher but-for costs.

would find ways to steer through other means. For example, nothing prevents a developer advertising lower prices outside Google Play, reaching users through social media or online forums, or turning its app into a "consumption-only" app.[100] Even assuming Dr. Singer's theory is correct, to say that "these incentives are absent in the actual world" is not accurate. Ultimately, this is an empirical question and Dr. Singer provided no evidence to support his hypothesis.

84. In fact, empirical observations from South Korea show that Google did not change its service fee rate when rival platform ONE Store entered and that developers do not tend to offer lower-priced apps on ONE Store, even though ONE Store offers a lower service fee. Among the top 50 paid apps in ONE Store, 31 apps are also available in Google Play, among which 18 apps (58%) offer the same price in both app stores, 8 apps (26%) offer a higher price in ONE Store, and only 5 apps (16%) offer a lower price in ONE Store. That is, 84% of these top apps are either priced the same or higher in ONE Store. See Figure 7. In other words, despite Dr. Singer's recognition that with ONE Store, "developers can now (setting aside any restrictions by Google) steer their customers to the lower-cost platform via discounting prices to consumers for Apps," vast majority of these top apps do not do so.[101] While Dr. Singer claims that there may be other "restrictions by Google," none of the alleged restrictions prevents a developer from setting a different price in the ONE Store. As discussed above, if developers have a strong incentive to steer consumers, they would set a lower price in the ONE store and steer through other means (e.g., word of mouth or other forms of publicity such as digital advertising outside Google Play).

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[100] As Dr. Rysman explains, "some developers, such as Amazon, Netflix, and Tidal, decided to make their Android apps 'consumption-only,' meaning that digital content may be purchased outside the app (such as on the web) to be used in the app. The result is that consumers cannot buy in-app what they could before, like Kindle books or movie streaming." Rysman Report ¶ 508.

[101] Singer Report ¶ 309.

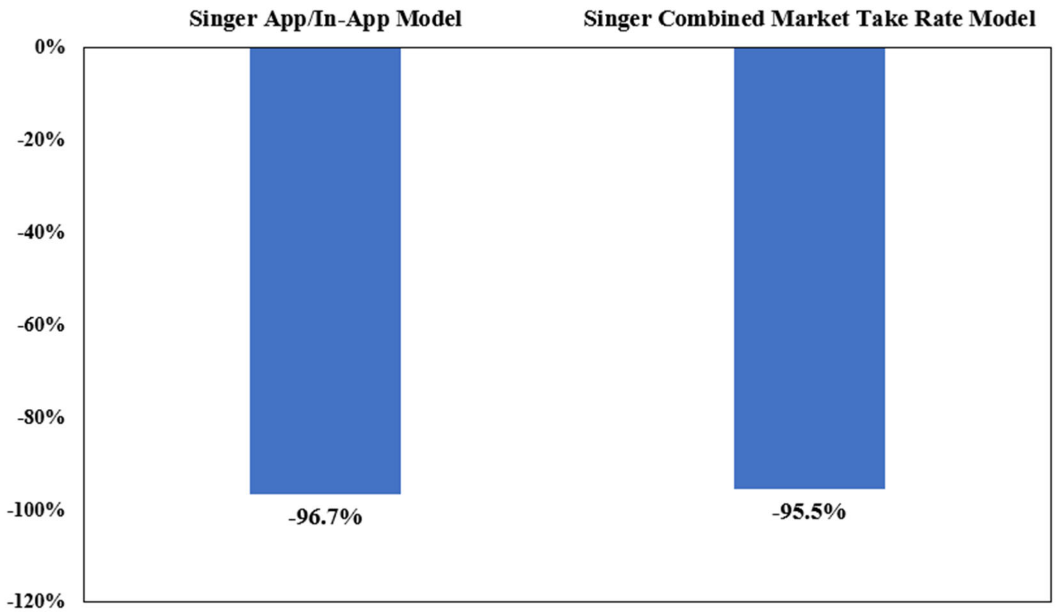
Figure 7. Prices of Top Paid Apps in ONE Store vs. Google Play in South Korea

App Name	App Price	
	ONE Store	Google Play
The Cloud Dream of the Nine M	33,000 Won	33,000 Won
Dead Cells	21,000 Won	12,000 Won / In App Purchase
Some Some Store: Love Convenience Store	15,000 Won	15,000 Won
Miracle snack shop	14,000 Won	14,000 Won
Wonder Boy: The Dragon's Trap	10,000 Won	12,000 Won
Dawn of Flower	15,000 Won	In App Purchase
When you wish upon a star	7,000 Won	7,000 Won
Knight Run: Homecoming	11,000 Won	11,000 Won
Love Flute	10,000 Won	10,000 Won
White day: A labyrinth named school	8,800 Won	8,900 Won
Lu Bu Maker	8,000 Won	8,000 Won
DragonSpear-EX	5,900 Won	5,900 Won
She is Mermaid	5,000 Won	5,000 Won
Some Some Convenience Store / Soohee After Story	5,000 Won	5,000 Won
Istelia Story	2,300 Won	2,300 Won
Persephone	4,000 Won	6,500 Won
Shin Hayarigami - Blind man	3,300 Won	3,300 Won
Inbento	3,000 Won	2,300 Won
Cut the Rope: Time Travel	3,000 Won	Free / In App Purchase
Sweatshop Diary DX	3,000 Won	Free / In App Purchase
Memorize Season 4	3,000 Won	3,000 Won
My future girlfriend greeted me	3,000 Won	3,000 Won
Dungeon Warfare	2,900 Won	3,300 Won
The Pleiades of Dreaming Starlight	2,900 Won	2,900 Won
Shin Hayarigami - Doll	2,200 Won	2,200 Won
Decalcomanie	2,000 Won	2,500 Won
Go Stop Puzzle2	1,999 Won	Free / In App Purchase
Dead End 99	1,900 Won	1,900 Won
Hero Rescue Girl: Pin Puzzle	1,000 Won	Free
Cobra Strike	1,000 Won	999 Won
Naval Warfare Korea vs Japan	1,000 Won	1,000 Won

Source: Exhibit 6.

85. Dr. Singer's damages calculation is highly sensitive to his assumed large pass-through rate. I have replaced Dr. Singer's unsupported pass-through rate assumption with the pass-through estimate I obtained from my empirical analysis and then re-run Dr. Singer's overcharge damages calculations. The result is to decrease Dr. Singer's three overcharge damages calculations by over 95%. See Figure 8.

Figure 8. Percentage Change in Consumer Class Damages based on Dr. Singer's Damages Models with Empirical Pass-Through Rate Estimate of 3%



Source: See Exhibit 7a.

3. The Theoretical Models Dr. Singer Uses to Determine the But-For Google Play Service Fee Rate Are Flawed and Unsupported

86. As noted above, the first step in Dr. Singer's overcharge damages calculations is to determine the but-for Google Play service fee rate. He does this for each of his "markets" (downloads, IAP, or combined downloads/IAP) using a theoretical model, having made particular assumptions about certain parameters of the model. However, the theoretical models are a poor description of the real-world marketplace and Dr. Singer's assumptions regarding the parameters of the models are unsupported and, in some cases, make no economic sense. Thus, Dr. Singer's theoretical models do not provide an economically valid means of determining the but-for Google Play service fee rate.

a. Dr. Singer's Assumptions About Model Parameters Are Unsupported or Flawed

87. Economic models typically require that values be chosen for model "parameters" in order to produce quantitative results. Even if a model is a good fit for an industry, the model will produce flawed results if incorrect values of the model parameters are chosen. Here, Dr. Singer has chosen to use inputs and assumptions that are unsupported or flawed. Even taking his modeling framework as given, economically plausible changes to the value of even a single such input can have a large impact on overcharge damages that Dr. Singer's theoretical models produce.

88. **Google Play's Actual Market Share.** Google Play's actual market share is an input to Dr. Singer's theoretical models. For the purposes of my report, I take Dr. Singer's market definitions as given. In his download (app distribution) model, Dr. Singer assumes that Google Play's actual market share is 100%.[102] In his IAP model, Dr. Singer assumes that Google Play's actual market share is 97%, based on the percentage of developers (not weighted by developer revenue) that sell digital products (paid downloads, IAP, and subscriptions) on Google Play *and* comply with the Google Play Billing policies (i.e., use Google Play Billing).[103] These assumptions regarding Google Play's actual market share are flawed and unsupported for the following reasons.

89. First, the assumption for actual market share should simply be based on Google Play's actual share of the transactions in question (e.g., Android app paid downloads and IAP in the case of Dr. Singer's combined downloads/IAP model). Google Play faces competition from other Android app stores (e.g., Samsung Galaxy Store and Aptoide) and other app distribution channels

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[102] Singer Report fn. 686. Dr. Singer directly used Google Play's actual world firm-specific consumer product price elasticity as the actual world market-wide consumer product price elasticity, which implies a 100% actual world share for Google Play in the claimed market.

[103] Singer Report fn. 748.

on Android (e.g., sideloading). Dr. Singer himself provides data on Google Play's actual market share that account for these forms of competition. These data show that Google Play's share of downloads/IAP is well below the 100% that Dr. Singer assumes. For example, Dr. Singer claims that "[d]ata from industry analysts on mobile app expenditures (which aggregates consumer expenditures on both initial downloads and in-App purchases) confirm … that the Play Store alone accounts for the vast majority of mobile app expenditures outside China and distinct from iOS… the Play Store accounted for 85.9 percent of non-Apple mobile app expenditures outside of China in 2018."[104]

90. For the IAP model, Dr. Singer uses the share of developers (unweighted by revenues) who comply with Google's Payments Policy among those who sell digital products (paid downloads, IAP, and subscriptions) on Google Play to obtain the 97% market share.[105] However, developers who do not comply are likely to be larger developers that have their own payment processing tools, such as Spotify, Epic, and Match. Therefore, Dr. Singer's failure to weight developer counts by developer revenues means that Google Play's share of developer revenues is likely to be substantially lower than its share of developers (i.e., the 97% that Dr. Singer assumes is Google Play's actual market share in IAP).[106] In fact, Dr. Rysman provides estimates of Google Play Billing's revenue-based share in the "IAP billing services market," which show a decrease from [redacted] in 2017 to [redacted] in 2021.[107]

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[104] Singer Report ¶ 122. I do not offer an opinion as to whether these figures are accurate.

[105] Singer Report Table 8.

[106] See Burtis Report ¶ 78. "In 2021, the top 10 putative developer class parents accounted for [redacted] of all putative developer class members' consumer spend, and the top 30 developer parents accounted for [redacted] of consumer spend."

[107] Rysman Report ¶¶ 354 – 355 and Exhibit 52. The weighted average share based on Dr. Rysman's estimates is 86.7%. I do not offer an opinion as to whether these figures are accurate.

91. **Google Play's But-For Market Share.** Another key input to Dr. Singer's theoretical models is Google Play's share in the but-for world. The difference between the assumed actual share and assumed but-for share is an important driver of the "overcharge" in service fee rate that the theoretical model generates. Dr. Singer assumes that Google Play's but-for share would have been 60%. He bases this assumption on the experience of AT&T's long-distance wireline telephone service in the early 1980s following entry by competing services such as MCI and Sprint. As a result of the entry of these competitors, AT&T's share of the total minutes of long distance phone calls decreased from its pre-1982 level of nearly 100% to 60% in 1993, over a ten year period.[108]

92. Dr. Singer's use of AT&T long distance wireline telephone service for consumers in the 1980s as a "benchmark" for Google Play's services for smartphone app developers in the current day is entirely invalid as a matter of economics. In order for AT&T to be a reliable benchmark for Google's but-for world market share, Dr. Singer must demonstrate that the long-distance wireline telephone service market in the 1980s is economically similar to Android app distribution and IAP services today. However, Dr. Singer has done absolutely nothing to make such a showing. In fact, long-distance wireline telephone service bears no identifiable resemblance to either app distribution or IAP.

- These services are of an entirely different nature provided to different types of customers. Long distance service allowed a person to call another person on a landline phone; the paying customer was the caller who initiated the call, either a consumer or a business. App distribution and IAP are about the distribution of a

[108] Singer Report ¶ 328, fn. 686; Kahai et al. (1996) p. 502. Interestingly, during the 1982-1984 period, AT&T decreased its long distance prices by only about 6-12% and on a gradual, rather than sharp, basis. See Federal Communications Commission, "Reference Book of Rates, Price Indices, and Expenditures for Telephone Service," June 1999. This contrasts to the large (50%) and immediate price decreases that Dr. Singer assumes Google would have implemented in the but-for world in this case.

developer's apps to smartphone users and handling in-app purchases by smartphone users. The paying customers are the app developers and the consumer in the app distribution market, and the app developer in the IAP market.

- The technologies used are largely unrelated and thus there is no reason to believe the cost structures are similar, either for the incumbents or for the potential entrants. AT&T and its competitors provided long distance phone service on their respective proprietary landline telephone networks. Google and other app stores provide services to app developers and using a type of computing infrastructure that did not even exist in the 1980s.
- Long-distance wireline telephone service was one-sided with some direct network effect, while app distribution services are two-sided with indirect network effects and potentially some direct network effects.
- The providers are entirely different entities (AT&T, MCI, and Sprint versus Google, Samsung, etc.) with different incentives.
- The change in the market landscape that led to entry in the case of AT&T (AT&T being required to connect long distance calls carried by competitors given that AT&T still had a monopoly in local exchange at that time[109] was different than the change in market landscape that allegedly would have occurred in the but-for world in this case (a relaxing of certain Google Play policies).

93. Dr. Singer then uses Alcoa as another benchmark to argue that even the 60% market share is conservative. Dr. Singer cites an academic article that estimates "Alcoa's capacity-based market share, on average, is 35%."[110] Alcoa is even more remote than AT&T in terms of being a reasonable benchmark for Google Play. First, as the title of the article Dr. Singer cited indicates, Alcoa is a producer of "a homogeneous product." Competition in a homogeneous commodity market takes place more on prices and less on other attributes of the product. Production capacity, both the industry total capacity and how that capacity is distributed across producers, is an

[109] See https://www.investopedia.com/terms/b/babybells.asp: "Although [the Baby Bells] had monopolies over local phone service in their respective areas, long-distance phone service opened up to the competition."

[110] Sheng-Ping Yang, Identifying a dominant firm's market power among sellers of a homogenous product: an application to Alcoa, Applied Economics, 34:11, 1411-1419.

important determinant of marketplace outcomes. Notably, the Alcoa share provided by the article Dr. Singer cites is based on production capacity. In contrast, Google Play and other competing App stores are not selling a homogenous product and they do not have any production plants. Moreover, commodity markets like aluminum are one-sided, not two-sided like the the Google Play platform. There are no direct or indirect network effects in the aluminum market of the types that are present with two-sided platforms such as Google Play store. In short, the important aspects of competition that shape market outcomes are entirely different for a one-sided homogeneous commodity producer with a certain amount of production capacity than for a two-sided platform offering differentiated services with network effects and no production capacity.

94. In his class certification Rebuttal Report, Dr. Singer further argues that three additional "benchmarks" also show his assumption of 60% market share is conservative. These are Netflix, IBM, and Microsoft Internet Explorer. Specifically, regarding Netflix, he notes that "as recently as 2014, approximately nine out of every ten SVOD households were Netflix subscribers," but "as of Q4 2021, Netflix had a streaming share of just 25 percent, compared to Amazon Prime's 19 percent, Disney + and Hulu at 13 percent each, and HBO Max at 12 percent."[111] Regarding IBM, he argues that "competition from other PC makers such as Compaq and Apple Computer dissipated IBM's market share, which fell from 80 percent to 20 percent in the decade between 1982 and 1992."[112] Finally, he notes that "In 2004, Internet Explorer enjoyed 95 percent market share.... Recently, Google Chrome has supplanted Microsoft's browser offering (now called Edge) at the top of the market, with a usage share of 65 percent of of all browsers, compared to 19 percent for

[111] Singer Class Rebuttal Report ¶ 91.

[112] Singer Class Rebuttal Report ¶ 92.

Safari and only 4 percent for Edge."[113] These claimed benchmarks suffer the same types of flaws as AT&T and Alcoa that I discussed above. For example, the PC market in which IBM participated was a standard one-sided market. Similarly, the size of any direct or indirect network effects for Netflix and competing streaming services is not clear. Internet Explorer and competing browsers that Dr. Singer cited are portals to the open worldwide web. An open website publisher does not need to ever *choose* to be on one of the browsers. Consumers can visit sites using any internet browser. The Internet browers that Dr. Singer cited are also free and do not charge either consumers or publishers for the use and therefore operate a different type of service than the Google Play store. Dr. Singer's benchmarks range from a long-distance telephone service provider to an aluminum producer, while ignoring the nature of competition and competitive dynamics that are essential to Google Play store.

95. In asserting that the but-for Google Play share would have been only 60%, Dr. Singer claims that having "app stores side-by-side on their [users'] mobile phone's home screens … can lead to competitive outcomes that benefit both buyers and sellers."[114] However, the real-world example of the Samsung Galaxy Store shows the opposite. Although the Samsung Galaxy Store is pre-installed on nearly all Samsung devices, which present Samsung device users at least two app stores "side-by-side on their mobile phone's home screens," Samsung Galaxy Store's share of consumer spend relative to the total consumer spend from the Google Play and Samsung Galaxy Store on Samsung devices remained low; for example, it was below [redacted] during the period of January 2018 to October 2020, based on the U.S. market consumer spend data for Google Play

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[113] Singer Class Rebuttal Report ¶ 93.

[114] Singer Report ¶ 283.

and Samsung Galaxy Store among Samsung devices.[115] This suggests that even with the presence of competing app store(s) in the but-for world, Google Play may still have been able to retain a high market share.

96. Dr. Singer has argued that while "Samsung's Galaxy Store is preinstalled on all Samsung Android devices, …, Samsung's Galaxy Store has not provided effective competition for the Play Store, …, in part due to Google's conduct, the Galaxy Store has not gained widespread traction with developers."[116] Therefore, Dr. Singer may respond to Google Play's large share on Samsung devices by arguing that it was caused by Google's alleged anticompetitive conduct. However, the qualitative evidence Dr. Singer presented cannot show that Samsung would have had a significantly larger share in the but-for world. For example, Dr. Singer reports that only eight of the top 20 most-downloaded Play Store apps were available in the Galaxy Store. But Dr. Singer presented no evidence that the Galaxy Store would have more such apps in the but-for world. Nor does he explain how Google's alleged conduct caused some apps not to be on the Galaxy Store, but not others. At the same time, Dr. Singer ignores the apps that are exclusive to the Galaxy Store.[117] In fact, it is possible that, in the but-for world, not every app would have been in every

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[115] See Exhibit 14.

[116] Singer Report ¶133.

[117] The Samsung Galaxy Store offers exclusive apps "made for Samsung" that are not available in Google Play, such as Tubi for Samsung, Touch of Modern for Samsung, Good Lock, and Samsung Sans.

app store. Competition may very well have resulted in both multi-homing and single-homing apps and developers.[118,119]

97. Dr. Singer's overcharge damages are thus highly sensitive to his assumptions regarding the actual and but-for Google Play market shares. I show in Figure 9 below the consumer overcharge damages produced by Dr. Singer's combined market take rate model, using alternative values for Google Play's actual and but-for market shares while keeping the remainder of the model unchanged.[120] As the graph shows, the closer Google Play's assumed but-for market share is to its assumed actual market share, the smaller the service fee rate overcharge generated by Dr. Singer's theoretical model and thus the smaller the overcharge damages are calculated to be.[121] For example, even taking Dr. Singer's inflated actual market share assumption of 97% as given, merely changing the assumed but-for share from 60% to 75% reduces Dr. Singer's damages by 40.9%. Similarly, if the actual market share is assumed to be 85%, rather than 100%, the damages would be reduced by 24.6% even if Dr. Singer's 60% but-for market share is retained. Setting the actual share to be 85% and the but-for share 75%, without changing anything else in Dr. Singer's

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118 Dr. Singer acknowledges that "a developer would not have to offer Apps on multiple stores in order to benefit from the results of competition in the but-for world. The mere threat of developers defecting to a competing platform, combined with actual defection (and steering) by other developers, would spur Google to decrease its take rate, in order to keep as many developers as possible on its platform." Singer Class Rebuttal Report ¶62. Yet, he never accounts for the adverse effects this outcome may have on some consumers.

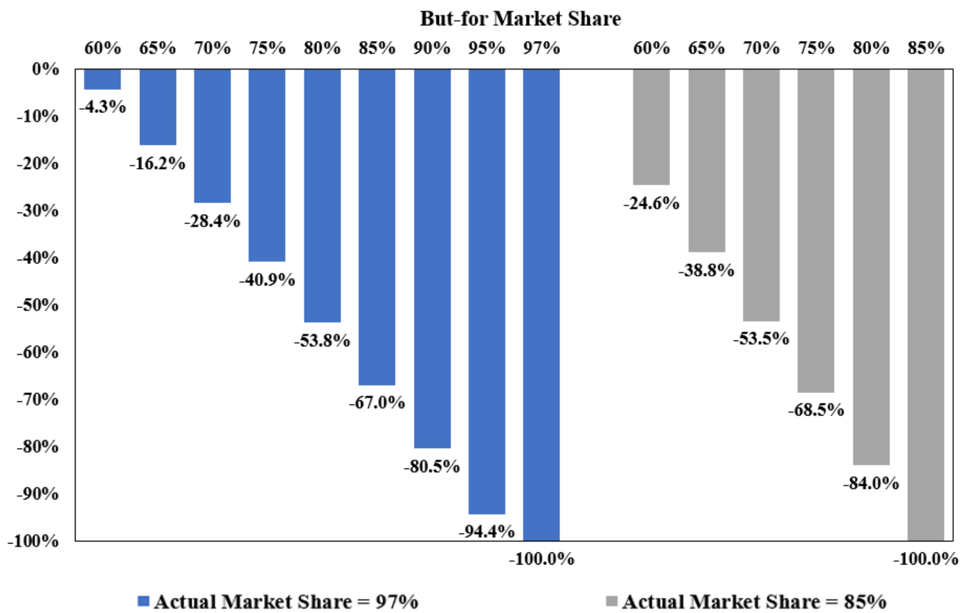
119 I also note that Dr. Singer argues that [redacted] Singer Report ¶ 205. However, I understand that Project Banyan was never implemented.

120 I show how his other models change with alternative market share values in Exhibits 8a-8b.

121 This is driven by that in Dr. Singer's damages models, Google Play's consumer-side and developer-side demand elasticities are derived based on the formula in Landes and Posner (1981), $E_g = \frac{E_M}{S_g} + \frac{E_S(1-S_g)}{S_g}$. For the app distribution market model, the single take rate model, and the single market hybrid model, Dr. Singer assumes the competitor supply elasticity E_S to be zero, hence leading to $E_g^{BF} = \frac{E_M}{S_g^{BF}} = E_g^A \frac{S_g^A}{S_g^{BF}}$. The higher $\frac{S_g^A}{S_g^{BF}}$ is, the higher the but-for consumer and developer price elasticities would be, resulting in lower but-for service fee rate and app price, and hence higher consumer damages. This holds directionally true for the IAP aftermarket model, even though he does not assume E_S to be zero in that model.

model, reduces Dr. Singer's damages by 68.5%. Dr. Singer's other overcharge damages models are similarly highly sensitive to economically plausible changes to his market share assumptions.[122]

Figure 9. Percentage Change in Consumer Class Damages based on Dr. Singer's Combined Market Take Rate Model with Alternative Google Play Market Shares



Source: See Exhibit 7b.

98. **Shape of the Demand Curve.** Dr. Singer assumes that the actual and but-for market consumer price elasticities are the same, which implies that Dr. Singer is assuming in his models that aggregate consumer demand has a "constant elasticity" functional form.[123] As noted above,

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[122] As noted below, the theoretical models that Dr. Singer uses in his consumer subsidy damages models are also sensitive to changes in the assumptions about the actual and but-for Google Play shares.

[123] Specifically, in all of Dr. Singer's models except the IAP model and Amazon discount model, he calculates the but-for buyer-side product price demand elasticity faced by Google Play, i.e., the change in the quantity demanded for consumers for transactions in a given alleged market (i.e., for Android app distribution market transactions in the model for the app distribution market) from Google associated with a change in the app product price based on the Landes and Posner (1981), $E_g = \frac{E_M}{S_g} + \frac{E_S(1-S_g)}{S_g}$. In all these calculations, he assumes that the market buyer-side demand elasticity (E_M), i.e., the change in the market-wide quantity demanded for consumers for transactions in a given alleged market associated with a change in the market app product price change, to be the same in the actual and but-for worlds. This implies that Dr. Singer is assuming in his models

different choices regarding demand curve shape have different consequences for the rate of pass-through for marginal cost and service fee rate changes. Other outcomes of a theoretical model likewise can depend on the particular demand curve shape that is assumed in the model. For example, for some demand curve shapes, the elasticity of demand increases as the price increases.[124] A model that assumes such a demand curve shape is likely to predict a smaller price increase due to a structural change (such as a cost increase) than an otherwise equivalent model that assumes a demand curve shape for which the elasticity of demand stays constant as price increases. The reason is that the increasing elasticity of demand makes it increasingly costly (in terms of lost sales) for the firm to increase its price.

99. Had Dr. Singer assumed a different functional form for demand than constant elasticity, his models would have produced different overcharge damages figures. The differences that result from different functional form assumptions can be substantial. For example, had Dr. Singer used linear demand instead of constant elasticity demand, he would have calculated smaller overcharge damages figures. Dr. Singer acknowledges that the demand curve can take different shapes and discusses other choices of demand curves, including a downward-sloping linear demand curve.[125] Yet, despite the importance of the choice of demand curve shape for his damage models, Dr. Singer failed to provide any empirical or other support for his choice of the constant elasticity demand curve shape over other shapes, such as linear.

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that the market consumer demand has a “constant elasticity” functional form, i.e., the market consumer price demand elasticity stays the same at different product price points. His IAP model does not involve consumers (since he alleges the IAP market is one-sided) and follows the same calculation for developers. Therefore, I apply the same sensitivity analysis to the developer side for the IAP model. Dr. Singer’s Amazon discount model does not rely on demand elasticity calculations at all.

[124] Linear demand is an example. For a linear demand curve $Q = \alpha - \beta P$, the elasticity of demand at price P is $-\beta P/(\alpha - \beta P)$. This expression becomes a larger number in absolute value as P increases.

[125] Singer Report ¶ 336 and Singer Class Rebuttal Report ¶ 74.

100. To illustrate how the demand functional form could affect Dr. Singer's overcharge damages calculations, I replace the constant price elasticity demand function with a linear demand function for the market consumer demand in Dr. Singer's overcharge damages models, while keeping everything else in his models unchanged. With a linear demand curve, the pass-through rate is 50% with constant marginal costs,[126] and the but-for market-wide consumer price elasticity would also be lower as compared to Dr Singer's estimates, leading to lower consumer damages. Intuitively, this is because, with a downward-sloping linear demand curve, the consumer product price elasticity decreases with price.[127] Since Dr. Singer's damages models all predict a lower but-for price, the but-for market-wide consumer product price elasticity would be lower. As shown in Figure 10, using a linear market demand function, Dr. Singer's calculation of overcharge damages based on combined download/IAP would decrease by about half.

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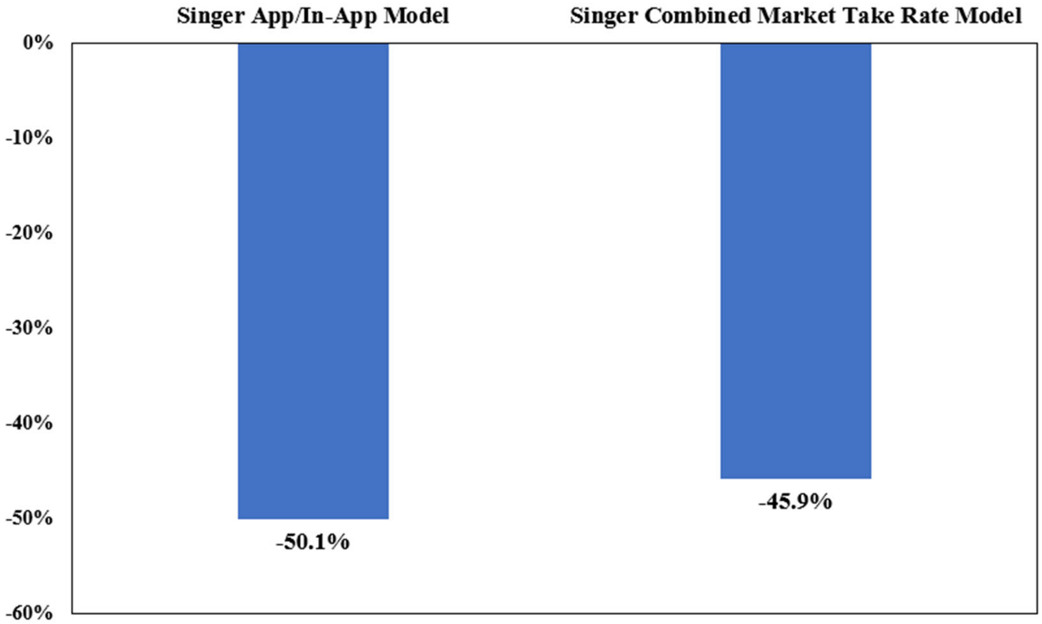
[126] Pless, Jacquelyn, and Arthur A. van Benthem, "Pass-through as a test for market power: An application to solar subsidies." *American Economic Journal: Applied Economics*, Vol. 11, No. 4, 2019, p. 374.

[127] See, e.g., Robert S. Pindyck and Daniel L. Rubinfeld 1995, Microeconomics, 3rd edition, 1995, p.30 ("Slope is constant for this linear demand curve. Near the top, price is high and quantity is mall, so the elasticity is large in magnitude. The elasticity becomes smaller as we move down the curve.")

Figure 10. Percentage Change in Consumer Class Damages based on Dr. Singer's Damages Models with A Linear Demand Curve



Source: See Exhibit 7c.

101. **Competitor Supply Elasticity.** In his IAP model, Dr. Singer assumes the supply elasticity of Google Play's competitors in the alleged IAP market, i.e., "the percentage increase in the quantity [of the in-app aftermarket services] supplied by Google's rivals, given a one percent increase in Google's price," to be 4.38 in the but-for world based solely on the estimated supply elasticity for AT&T's long-distance wireline telephone service competitors in the 1980s.[128] Dr. Singer does not conduct any empirical analysis or provide any supporting evidence to demonstrate that the elasticity of competitor supply for IAP in the but-for world would have been 4.38. As was the case for the Google Play but-for market share, Dr. Singer provides no support for the claim that the experience of the long-distance wireline telephone service in the 1980s provides a reasonable benchmark for what would have happene in the but-for world in this case.

[128] Singer Report ¶¶ 326, 328, and 332.

102. For the reasons previously discussed, the two situations are not similar along any important economic dimension. It is instructive to review the Kahai, et al. (1996) research paper that estimated the competitor supply elasticity of 4.38 that Dr. Singer uses. Kahai, et al. (1996) assumed a dominant firm/competitive fringe (DF/CF) model, which imposes assumptions on the market structure, including that "(1) there is one firm that holds a relatively large share of the market (that is, the dominant firm); (2) there is a competitive fringe, consisting of a large number of much smaller firms, each of which takes the dominant firm's price as given; and (3) the product is homogeneous."[129] Unlike Dr. Singer, Kahai, et al. (1996) made an effort to show that the characteristics of the long-distance wireline telephone service industry, in a limited time period, "conform reasonably well with the assumptions underlying the DF/CF model."[130] For example, for the competitive fringe assumption, the paper shows that in the time period studied AT&T faced a "considerably fragmented set of individually relatively small competitors," with the number of competitors being 170 at the beginning of the time period studied and growing to 440 at the end, and no single competitor holding more than 6% of the market share during the time period studied.[131] For the product homogeneity assumption, the paper compares the functions and features of the long-distance calling services as well as consumers' willingness to switch long-distance carriers to support that the long-distance services were viewed by consumers as essentially homogenous.[132]

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[129] Simran Kahai, David Kaserman & John Mayo, "Is the 'Dominant Firm' Dominant? An Empirical Analysis of AT&T's Market Power," 39 Journal of Law & Economics 499-517 (1996) (hereafter "Kahai et al. (1996)"), p. 502.

[130] Kahai et al. (1996), p. 505. In fact, as the paper points out, even the applicability of the long-distance wireline telephone service industry declines as the industry structure evolves. See Kahai et al. (1996), p. 513.

[131] Kahai et al. (1996), p. 503.

[132] Kahai et al. (1996), pp. 503-504.

103. In contrast,, Dr. Singer did nothing to show that his IAP market in the but-for world would have had these same characteristics and, in fact, empirical evidence suggests that it would not. For example, Dr. Singer's own purported IAP market includes PayPal, Stripe, and other payment processing services as potential competitors. These competitors would not be "fringe" price takers. PayPal holds a market share by the number of transactions of 54% in the online payment processing market, and Stripe holds a market share of 19%.[133] These competitors are by no means "much smaller" price takers, and in fact they offer different pricing.[134] Moreover, Dr. Singer assumes that in the but-for world Google would have lost 40% market share to a single competitor. Such a firm could hardly be called a "fringe" firm with a "trivial share of the market." Therefore, Dr. Singer's input of 4.38 for the competitor supply elasticity in his IAP model is unsupported and arbitrary.

104. Below I illustrate the sensitivity of Dr. Singer's damage estimates to the choice of competitor supply elasticity in Figure 11 below, keeping everything else in his model the same. For example, changing the supply elasticity to 2 leads to a 7.5% reduction in Dr. Singer's damages estimate, and changing the supply elasticity to 0 leads to a 26.7% reduction in Dr. Singer's damages estimate.

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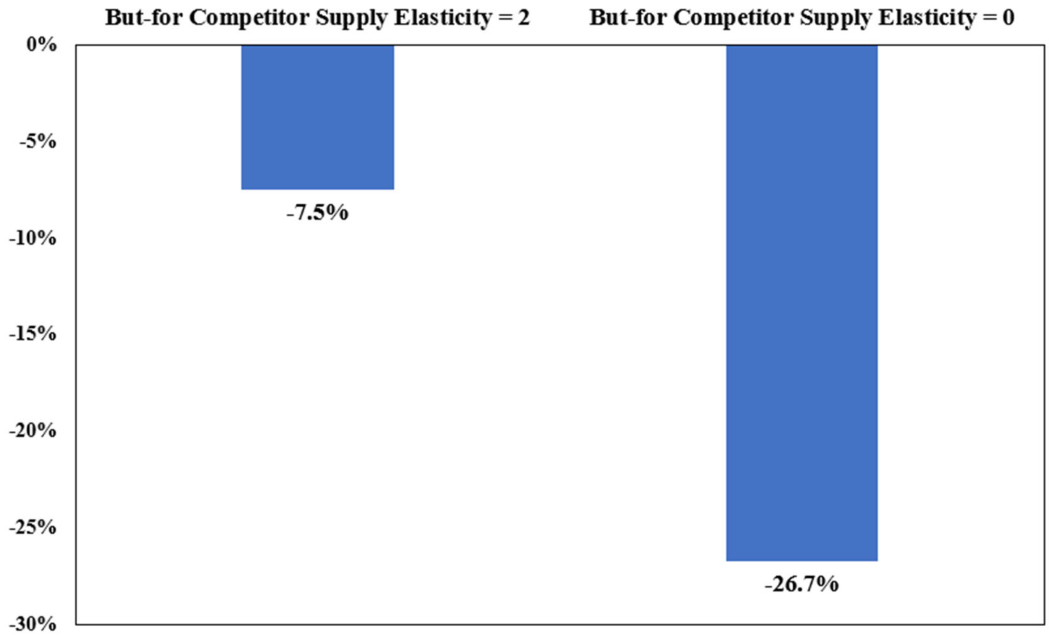
[133] See https://www.datanyze.com/market-share/payment-processing--26, https://www.cardrates.com/advice/credit-card-processors-market-share/.

[134] For example, Paypal and Stripe's pricing systems have different rates for different types of transactions. According to PayPal's website, the typical US rate for "All Other Commercial Transactions" is 3.49% plus a fixed fee of $0.49. "Standard Credit and Debit Card Payments," are priced at 2.99% plus the $0.49 fixed fee. Stripe charges 2.90% + $0.30 for card payments and 2.90% rate + $0.30 fee plus $10/month subscription for checkout. For example, Square charges 2.6% + 10c. https://squareup.com/us/en/campaign/square-vs-competitors. Stripe charges 2.9% + 30c, plus additional fees for services such as invoicing. https://stripe.com/pricing#pricing-details. Amazon Pay is free for small businesses; https://pay.amazon.com/business/small-business.

Figure 11. Percentage Change in Consumer Class Damages based on Dr. Singer's IAP Model with Alternative Competitor Supply Elasticities



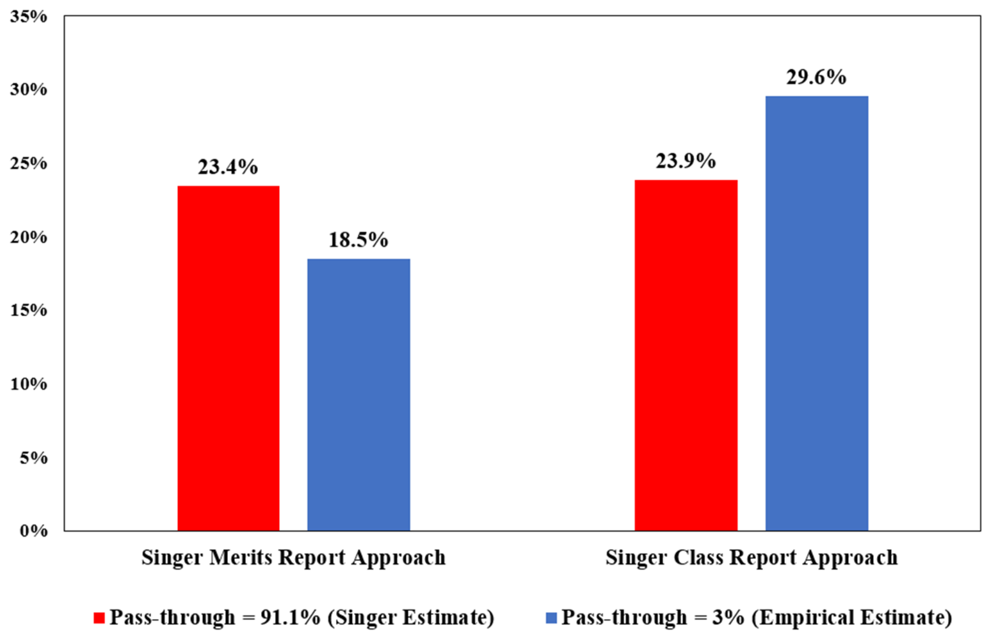
Source: See Exhibit 7d.

105. **Other Model Parameters.** Dr. Singer applied different assumptions to calculate the developer take rate elasticity, i.e., the change in the quantity supplied by developers in each alleged market in response to change in the service fee (dollar amount), in his merits report dated October 3, 2022 from his class report dated February 28, 2022: in his class report, he assumed the developer take rate elasticity to be the same in the actual and but-for worlds, while in the merits report, he assumed that the but-for developer price elasticity would have been the actual developer price elasticity divided by the but-for market share (60%).[135] This difference alone, besides increasing the consumer damages, changes the relationship between some of his key model outputs. As shown in Figure 12 below, in his app distribution market, keeping other assumptions and input the same, the but-for take rates under his merits report approach are generally lower with *lower* pass-

[135] Singer Class Report Table 6; Singer Report Table 8.

through rates, while the but-for take rates under his class report approach are generally *higher* with lower pass-through rates.

Figure 12. But-For Take Rates based on Dr. Singer's Class Report and Merits Report Combined Market Take Rate Model with Empirical Pass-Through Rate Estimate



Source: See Exhibit 7e.

Overall, Dr. Singer's damage models are sensitive to his choices of model inputs. As an illustration of the combined effect of the model inputs discussed above on his damages estimates, I show in Figure 13 below that Dr. Singer's combined downloads/IAP model yields damages estimates from as low as zero to [redacted] assuming a pass-through rate of 3% and alternative values for Google's actual and but-for market shares. See Exhibits 8a-8b for the combined sensitivities of Dr. Singer's other overcharge models.

Figure 13. Consumer Class Damages Sensitivities Based on Dr. Singer's Combined Market Take Rate Model

[redacted]

But-for Market Share

Pass-Through Rate = 91.1%, Actual Market Share = 100% (Singer Estimate/Assumption)
Pass-Through Rate = 3% (Empirical Estimate), Actual Market Share = 85%

Source: See Exhibit 7f.

b. The Landes and Posner (1981) Model Is Not a Sound Fit for Calculating Google Play's But-for Firm-Specific Price Elasticities

106. Dr. Singer calculates Google Play's consumer-side and developer-side firm-specific price elasticities in the but-for world following the formula for a firm-specific price elasticity derived in Landes and Posner (1981).[136] However, as explained in that paper, the firm-specific price elasticity is derived based on a market structure of "a single large or dominant firm … that faces competition in its sales from a fringe of domestic firms … each with a trivial share of the market" and that "all the firms in the market produce the same product."[137] The paper explicitly states that

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[136] Landes and Posner (1981) at 944. Specifically, the formula is $E_g = \frac{E_M}{S_g} + \frac{E_S(1-S_g)}{S_g}$, where E_g and E_M are price elasticities of demand for Google Play and for market-wide, S_g is Google Play's market share, and E_S is the elasticity of competitor supply.

[137] Landes and Posner (1981) at 944.

"[w]hat is critical is … that each member of the fringe have a small share, implying that the fringe firms have little incentive to engage in strategic behavior and thus that each is a price taker. If the other firms are not price takers, our analysis is not directly applicable."[138] To emphasize this point, Landes and Posner (1981) state that "the formula for the firm elasticity of demand technically is inapplicable when there is interdependent behavior among the leading firms."[139]

107. As discussed above, Dr. Singer conducts no empirical analysis and provides no support to show that the app distribution, IAP, and download/IAP markets in the but-for world satisfy the assumptions under the DF/CF model. In fact, the market structure requirement in the Landes and Posner (1981) model is inconsistent with Dr. Singer's but-for world characterization that "my analysis of a potential but-for world requires entry by only one viable rival App store platform."[140] In addition, empirical evidence indicates that competitor app stores (such as ONE Store, Amazon Appstore, and Aptoide) adopt different pricing schemes from Google Play, proving them not as price takers. Moreover, Dr. Singer assumes that this (potentially) single but-for app store would have achieved a 40% share in the but-for world. Such a firm could hardly be called a "fringe" firm with a "trivial share of the market."

C. Dr. Singer's Consumer Subsidy Damages Calculations

108. The fourth and the sixth of Dr. Singer's damages calculations focus on the subsidies that Google provided to consumers through Google Play Points. In the fourth calculation, Dr. Singer employed the same theoretical model as in the third calculation but assumed that consumer subsidy could have changed in the but-for world, while the service fee rate would have stayed fixed at the

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[138] Landes and Posner (1981), fn. 15.

[139] Landes and Posner (1981), p. 951.

[140] Singer Report ¶ 289

actual level. In the sixth calculation, Dr. Singer takes a different approach where he uses the consumer discounts provided by the Amazon Coins program as a benchmark for Google's consumer subsidies in the but-for world. Both of these calculations are flawed and unsupported.

1. All the Flaws of Dr. Singer's Theoretical Model Discussed Above Apply to the Consumer Subsidy Damages Calculation as Well

109. All of the invalid assumptions of Dr. Singer's theoretical model—the actual and but-for Google Play shares, the demand curve shape, the competitor's supply elasticity—render Dr. Singer's consumer subsidy damages calculation flawed and unsupported, just as they do Dr. Singer's overcharge damages calculations.[141] In Exhibit 8c, I perform the same set of calculations using alternative values of the key parameters to demonstrate the sensitivity of Dr. Singer's consumer subsidy damages calculation.

2. Dr. Singer's Amazon Benchmark Calculation Relies on Flawed Calculations and Assumptions

110. In the consumer subsidy damages calculation based on using the Amazon Appstore as a benchmark, Dr. Singer first calculated the implied discount rate on Amazon Appstore purchases on third party devices to be [redacted], and then assumed that in the but-for world Google Play would have offered consumers subsidies or other discounts in the amount of [redacted] of consumer spend (say, via Google's Play Points program[142]). Dr. Singer asserts that the difference between [redacted]

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[141] For the consumer subsidy damage calculations, Dr. Singer does not address pass-through, presumably because subsidies are directly provided by Google to consumers. However, under Dr. Singer's own arguments concerning the pass-through of the service fee, there could be "reverse" pass-through of a subsidy, whereby developers increase their app prices in response to the increase in subsidies. Such app price increases would offset the consumer subsidies. Dr. Singer does not consider this possibility. The possibility of such a reverse pass-through of consumer subsidy has been recognized in academic literature as well. See, e.g., Fan, Y. and Zhang, G. (2022), The welfare effect of a consumer subsidy with price ceilings: the case of Chinese cell phones. The RAND Journal of Economics, 53: 429-449.

[142] According to Dr. Singer, "Google awards Play Points for: (1) any purchase; (2) participation in weekly promotions (essentially getting extra points for spending on particular top games); and (3) installing new Apps

and the actual Google Play consumer subsidy of [redacted] applied to Google Play's consumer spend, represents consumer damages in the form of lost consumer subsidies.[143] This estimate is [redacted] larger than his other consumer subsidy damages calculation based on the theoretical model. He provides no explanation for this sizable difference. In fact, such a large difference illustrates that one or both calculations are incorrect.

111. In any event, Dr. Singer's consumer subsidy damages calculation based on the supposed Amazon discount is flawed and unsupported for a number of reasons. First of all, to the extent Dr. Singer is comparing Amazon Coins to Google's own customer loyalty program Google Play Points, the two are not comparable. Amazon Coins must be purchased in a separate transaction before they can be used to make digital purchases in the Amazon Appstore. Once purchased, Amazon Coins can no longer be converted back to cash.[144] In addition, a consumer must make a minimum purchase of 300 Amazon Coins and pay sales taxes, and the discount is lower on lower transaction amounts.[145] Given these restrictions, Amazon must offer some form of discount to entice consumers to convert cash into the virtual currency.[146] While one dollar worth of cash can be used to pay for anything in both the digital and physical settings, one dollar worth of Amazon Coins can only be used for digital purchases in a single specialized online store, and nothing else.[147]

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that Google selects. The points can then be spent on (a) Play credits (money to buy games); (b) priced initial App downloads or In-App Content; or (c) discounts on In-App Content. Consumers may also reach higher "tiers" as they accrue points, which gives them access to additional benefits." Singer Report ¶ 373.

[143] Singer Report ¶ 420.

[144] https://www.amazon.com/gp/help/customer/display.html?nodeId=201434520 (Section 2.5).

[145] https://www.amazon.com/dp/B06XCYXMQP?ie=UTF8&asin=B06XCYXMQP&denomination=300; AMZ-GP_00001629.

[146] This is akin to the well known liquidity discount, that is, assets with liquidity restrictions trade at a discount. See, e.g., Bajaj, M., Denis, D. J., Ferris, S. P., & Sarin, A. (2001); Firm value and marketability discounts. J. Corp. L., 27, 89.

[147] https://www.amazon.com/gp/help/customer/display.html?nodeId=201434520 (Section 2.1); https://www.amazon.com/b?ie=UTF8&node=21434128011

Google Play points, however, are earned with purchases that a consumer makes, rather than being purchased by the consumer. No separate transaction is involved, and they are generated as a "by-product" of a transaction the consumer often would make in the absence of the Play Points. Once Play Points are earned, they can be used directly to lower prices a consumer pays on future purchases within the Google Play store. In addition, Amazon coins *cannot* be used to buy in-app subscriptions and yet Dr. Singer applies his discount rate, which is largely based on Amazon Coins, to all types of purchases on Google Play including subscriptions,[148] nor can they be used together with cash or other forms of payment.[149] That means a user must buy additional coins if he or she does not have enough coins to make a purchase. For example, if a user buys 300 coins, but wants to buy something that requires 400 coins, the user would have to buy another 300 coins because they cannot use cash or another form of payment to make up the difference.[150] Play Points do not have such restrictions. Therefore, the discount amount based on Amazon Coins is not comparable to the discounts represented by Play Points. Dr. Singer speculates that "[m]ore broadly, Google could adopt other methods (akin to Amazon Coins) for providing direct consumer discounts." However, he offered no reason why Google would do so in the but-for world other than supposedly greater competitive pressure. Given the unique nature of the Amazon Coins, Dr. Singer cannot compare Amazon Coins-based discount to a very different Google Play-Points based discount that Google offers. Dr. Singer also does not make any adjustment to make them comparable.

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[148] See Morrill Deposition, Exhibit 1363.

[149] https://www.amazon.com/b?ie=UTF8&node=21434128011; https://arstechnica.com/information-technology/2013/05/amazons-new-virtual-currency-of-dubious-benefit-to-customers/; https://techengage.com/amazon-coins-deals/

[150] https://techengage.com/amazon-coins-deals/; https://arstechnica.com/information-technology/2013/05/amazons-new-virtual-currency-of-dubious-benefit-to-customers/.

112. Second, Dr. Singer claims that the Amazon discount on third party devices provides "a reasonable benchmark for calculating aggregate damages" but his only justifications for this claim are that (1) the Amazon Appstore also participates in the claimed Android App Distribution Market and (2) the Amazon Appstore is also available on third-party (i.e., non-Amazon) smartphones and tablets.[151] Dr. Singer's logic would imply that, whenever a premium brand product and a private label product are both in the same product market and they are both sold in third-party retail stores, the discounts offered by the two products must be comparable and similar. This is clearly false. As a matter of basic economics, discounts, like prices, depend on a host of other market factors including consumer demand, firms' business strategy, costs, and the competitive landscape. Dr. Singer says nothing about why the consumer demand, costs, business strategy, and competition for the Amazon Appstore on third party devices in the actual world would be similar to that of Google Play in the but-for world – users of the Amazon Appstore on third party devices and their demand may not be similar to Google Play store users, either in the actual or the but-for worlds. In fact, as Amazon's own strategy documents show, [redacted][152] Further, Dr. Singer has stated elsewhere in his report that Amazon Appstore is much smaller ([redacted] of the market), and Amazon Appstore on third party devices would represent an even smaller user base.[153]

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[151] Singer Report ¶ 418.

[152] Singer Report ¶ 418.

[153] Singer Report ¶ 120, citing Amazon documents. [redacted]

113. Moreover, Dr. Singer also does not present any evidence that the Google Play store would have been in a similar economic situation in the but-for world to the Amazon Appstore on third party devices in the actual world. Dr. Singer also does not provide any evidence why Google Play would have adopted the same business and pricing strategy as Amazon Appstore on third party devices, especially given that Amazon is known to price aggressively and even below cost in the context of complementary products.[154]

114. Third, Dr. Singer calculates the [redacted] as percentage of the total discounts out of total gross consumer spend on third party devices from 2018 to 2021, and claims that "the vast majority of discounts come in the form of Amazon Coins."[155] The Amazon Appstore total sales on third-party devices are about [redacted] between 2018 and 2021. However, this is a small slice of the overall Amazon app store sales. For example, Amazon Appstore sales are much greater on FireTV and tablets (each has total sales above [redacted] between 2018 and 2021) and Amazon offers a much lower rate of discounts on those devices – [redacted] for FireTVs and [redacted] for tablets between 2018 and 2021.[156] Although Amazon devices do not offer downloads of alternative app stores, it is still possible to sideload them, much as is the case with most Android devices.[157] Therefore, Dr.

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[154] Amazon has a documented history of pricing certain products at or below cost in order to gain market share or induce sales of adjacent products. Around 2011, Amazon launched the Kindle Fire tablet below cost, with the goal of inducing other sales (such as books, apps, advertising and Amazon shopping) on the platform. The Atlantic, citing IHS iSuppli, says that the tablet cost more than $209 to build while sold at $199. See "Yes, the Kindle Fire is a Loss Leader," *The Atlantic,* www.theatlantic.com, October 1, 2011, https://www.theatlantic.com/technology/archive/2011/10/yes-kindle-fire-loss-leader/337237/.

[155] Singer Report, fn. 954. However, Dr. Singer never explains exactly what discounts are included in his 19.26%. According to Morrill deposition exhibit 1364, total discounts include "Purchased Coins Redeemed Discount," "Other Discount Redeemed," and "Promo Discount." Dr. Singer did not explain what "Purchased Coins Redeemed Discount" entails and why that is the right information to use in his calculation. Morrill Exhibit 1364.

[156] Morill Deposition, Exhibit 1363.

[157] See, among others, How to Install the Google Play store on an Amazon Fire, https://www.wikihow.com/Install-the-Google-Play-Store-on-an-Amazon-Fire#:~:text=However%2C%20Fire%20OS%20runs%20on,the%20four%20required%20APK%20files., accessed November 5, 2022.

Singer has no valid basis to use only the discounts on third party devices and ignore the much smaller discounts Amazon offers on its own devices.

115. Elsewhere in his report, Dr. Singer claims several other app stores are reasonable benchmarks as well and yet he did not even examine the discounts offered by any store other than Amazon. I discuss these benchmarks in detail in section IX. Dr. Singer has not offered any evidence as to why Amazon on third party devices is either uniquely comparable to Google Play in the but-for world or Amazon app store's discount on third party devices is representative of all the other benchmarks he considers; in fact, it is not even representative of the Amazon Appstore on other devices as discussed above.

D. Dr. Singer's Hybrid Damages Calculation

116. Dr. Singer performs a hybrid damages calculation using the theoretical model for downloads/IAP where he allows both the service fee rate and the consumer subsidy to change in the but-for world. Thus, this calculation is a hybrid of a service fee overcharge damages calculation and a consumers subsidy damages calculation.

117. All the flaws that render Dr. Singer's overcharge and consumer subsidy calculations (based on the theoretical model) unsupported apply to the hybrid calculation as well. In Exhibit 8e, I summarize the ways in which Dr. Singer's hybrid calculation changes in response to same changes to the model assumptions that I have discussed above in the context of the overcharge and consumer subsidy calculations.

VII. CONSUMERS – DR. RYSMAN'S DAMAGES CALCULATIONS

A. Overview of Dr. Rysman's Damages Calculations

118. Dr. Rysman offers an overcharge damages calculation (that assumes the service fee rate would have been lower in the but-for world than the actual world, but the number of apps would have been the same), a variety damages calculation (that assumes that the number of apps would have been higher in the but-for world than the actual world, but that the service fee rate would have been the same), and a hybrid calculation (that assumes that both the number of apps would have been higher and the service fee rate would have been lower in the but-for world than in the actual world).[158]

B. Dr. Rysman's Service Fee Overcharge Damages Calculation

119. Dr. Rysman calculates consumer damages based on the assumption that the Google Play service fee rate in the but-for world would have been 15% and that the pass-through rate of service fees by app developers to consumers is 100%. Under these assumptions, service fee overcharge damages are consumers' Google Play dollar spend multiplied by 15%.

1. Dr. Rysman's Assumption of a 15% But-For Google Play Service Fee Rate is Invalid

120. Dr. Rysman asserts that "an upper bound on a service fee in the Android App Distribution Market in a but-for world in which Google does not monopolize the Android App Distribution

[158] Dr. Rysman uses his models to calculate damages for consumers in the Plaintiff States for the periods of August 16, 2016, through May 31, 2022, and August 16, 2016, through June 5, 2023. I note that in addition to the flaws in his damage models discussed below, there is no reason for Dr. Rysman to calculate damages beyond the end of the period for which sales data exist. To do so, he makes projections of sales, but these projections are speculative (for example, he does not account for confounding economic factors, such as the effect of the recent pandemic on sales, in his projections). Rather than calculating damages on unsupported sales projections, Dr. Rysman could calculate damages based on the actual sales data when those data become available.

Market would be 15%."[159] His only rationale for choosing the specific 15% figure appears to be that (1) Google has offered a similar rate to a small number of selected developers and the recent Google policy changed the service fee rate to 15% for certain types of transactions[160] and (2) "in the competitive but-for world competitive pressure on Google would be what Google has faced so far in the actual world plus additional pressure due to enhanced competition."[161] Dr. Rysman provided no justification, however, as to why, in the but-for world, Google would set a uniform 15% service fee rate across all transactions, all developers, and the entire alleged damages period. In fact, Dr. Rysman says nothing specific about the competitive conditions in the but-for world, other than claiming that Google would face more "competitive pressures."[162]

121. I note that Dr. Rysman's 15% but-for service fee rate is inconsistent with Dr. Singer's but-for service fee (23.4%) based on the Singer combined market take rate model. Dr. Rysman's overcharge damages calculation would be reduced by over half if he were to use Dr. Singer's 23.4% but-for service fee rate.

2. Dr. Rysman's Assumption of 100% Pass-Through Is Unsupported and Inconsistent With the Empirical Evidence

122. Dr. Rysman offers no support or defense for his assumption of a 100% service fee pass-through rate. Rather, he merely states that if another expert argues that pass-through is less than

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[159] Rysman Report ¶ 474.

[160] Rysman Report ¶ 495. ("I conclude that (i) an upper bound on competitive but-for service fee is most likely to be 15% which is consistent with most of the service fee discount programs that Google has implemented…")

[161] Rysman Report ¶ 536.

[162] Rysman Report ¶ 537. See also Rysman Report ¶ 475 ("If Google, in addition, faced competition in the Android App Distribution Market, then the service fee would reduce further thus making 15% a conservative estimate.")

100%, he reserves the right to adjust his damages calculation.[163] Dr. Rysman has certainly offered no empirical analysis of service fee rate pass-through.

123. To the extent that Dr. Rysman attempts to point to his theoretical model as support for his 100% pass-through assumption, the model offers no such support. The 100% pass-through rate that emerges from Dr. Rysman's model is simply the result of another unsupported assumption about the shape of the demand curves for apps used within the model. Dr. Rysman's particular choice of demand curve shape *dictates* that, within the model, 100% of a change in the service fee rate is passed through to consumers.[164] To be clear, the 100% pass-through in Dr. Rysman's model is effectively an *assumption*, not the result of any empirical analysis.

124. As noted above, it is well-established in the economics literature that, as a theoretical matter, the rate of pass-through depends on the shape of the demand curve and other economic conditions. With a different choice of demand curve, Dr. Rysman would have obtained a different, potentially lower, pass-through rate in his model. In Appendix E to this report, I show that using alternative demand curves within the basic structure of Dr. Rysman's model results in a pass-through rate that is well below 100%. Assumptions regarding the pass-through rate that are untethered to real-world evidence of the market being studied cannot be used to reasonably estimate damages in the but-for world.

125. The bottom line is that the rate of pass-through in a given real world context is an empirical question that must be addressed through empirical analysis. Rather than conducting the necessary

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[163] Rysman Report, fn. 1133 ("To the extent that other experts in this case opine that consumers felt less than 100% of the price effect of Google's conduct, I reserve the right in rebuttal to testify about the effect of those different assumptions on my model's calculations.").

[164] Dr. Rysman's model assumes that demand for an app is of the "constant elasticity" form. Rysman Report Appendix F. He provides no support for this particular choice of demand curve shape.

analysis and building the results of that analysis into his theoretical model, however, Dr. Rysman has simply assumed 100% pass-through.[165] As discussed above, I have conducted an empirical analysis that demonstrates that service fee rate pass-through for Google Play store apps is well below 100%. Because Dr. Rysman's assumption on pass-through is entirely at odds with economic reality, his overcharge damages calculations (including the combined variety/overcharge calculations) are flawed.

126. An additional theoretical point is that, with many demand curve alternatives to the particular one Dr. Rysman chose to use in his model, the service fee pass-through rate for an app is positively related to the app's marginal cost. Thus, for an app with relatively low marginal cost, the service fee pass-through rate can be close to zero as a theoretical matter.[166] In that case, real world pricing frictions such as an app's desire to use price points can lead to a zero real-world pass-through rate. For example, an app with low marginal cost and thus low pass-through may choose to remain at a preferred price point rather than change price slightly in response to a change in the service fee rate.

127. As an initial matter, that marginal cost tends to be small and even negligible in some cases for digital goods is well-recognized. For example, Weber (2008) states that "Information goods such as computer software or electronic newspapers can be provided by firms at a low marginal cost, though in many cases large capital outlays are required to produce their first unit….For information goods, the costs of reproduction and distribution are indeed very small, so that this

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[165] In his pure "variety" damages calculation, Dr. Rysman assumes zero pass-through. However, this model is subject to different unsupported assumptions that drive the results. With this model, as discussed below, the assumptions are not only unsupported by any evidence, but in fact inconsistent with market facts.

[166] See Appendix E.

has become a standard assumption in much of the extant literature."[167] Similarly, Jeffrey K. MacKie-Mason and Hal Varian (1994) state that "with information goods the pricing-by-replication scheme breaks down" and that "this has been a major problem for the software industry: once the sunk costs of software development are invested, replication costs essentially zero."[168] Lambrecht et al. (2014) state that "[s]uch [digital] goods are non-rival, have near zero marginal cost of production and distribution, low marginal cost of consumer search and low transaction costs."[169]

128. Dr. Rysman argues that marginal cost is "likely" positive for apps. As he notes, the assumptions of his model require that marginal cost must be positive for all apps. He cites certain costs of specific developers and argues that they are marginal costs. However, Dr. Rysman's example of Pure Sweat Basketball is misleading. He argues that "the Pure Sweat Basketball (PSB) 2019 P&L statement shows that advertising and marketing expenses plus salaries and wages accounted for about [redacted] of total revenues."[170] Based on PSB 2019 P&L statement, the company's app revenue [redacted][171] Therefore, PSB's [redacted][172] Even if one takes Dr. Rysman's claim that those

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[167] Thomas A. Weber, "Delayed Multi-attribute Product Differentiation," Decision Support Systems, Volume 44, Issue 2, January 2008, pp. 447, 451.

[168] MacKie-Mason, Jeffrey K., and Hal Varian. "Economic FAQs about the internet." *Journal of Economic Perspectives*, Vol. 8, No. 3, 1994, p. 92.

[169] Lambrecht, Anja, et al., "How do firms make money selling digital goods online?" Marketing Letters, Vol. 25, No. 3, 2014, pp. 331-341 at 331.

[170] Rysman Report ¶ 566.

[171] Czeslawski Dep., Exhibit DX0268 (PSB-GOOGLE-0009320).

[172] Czeslawski Deposition, page 335: 10-19.

are marginal costs, the [redacted] percent figure that he cited is based on PSB's firm-wide expenses and revenue and is therefore misleading.

129. Dr. Rysman then cites examples of other types of costs that he claims are marginal, yet he does no actual economic analysis to either quantify such costs or show that they are considered in price-setting for every app. Specifically, Dr. Rysman cites to the Epic Game P&L's breakdown of costs that include hosting/production costs, customer support costs, user acquisition costs, and operating expenses. He goes on to argue that "[t]hose costs *can* [emphasis added] be considered marginal costs because, to increase sales (or continue to generate sales in future periods) or support existing customers, an app would need to pay more for advertising and marketing and pay wages (that is, an app would need to keep buying labor hours to continue selling its app over time and providing customer support)." Dr. Rysman makes similar arguments about several other types of costs such as advertising and marketing costs, cost per install, user acquisition costs, and hosting and cloud computing costs. However, for Dr. Rysman to argue that these are marginal cost, he must demonstrate that these costs are factored into the pricing decision of the developers, as his model implies.[173] He did not do so. Instead, Dr. Rysman simply argues that as long as a certain cost goes up with the number of users or usage, then it is a marginal cost that affects pricing. Dr. Rysman's argument here confuses marginal cost and (average) variable cost. As a firm grows and serve more customers, certain cost categories may increase as well. However, the marginal cost associated with a small increase in sales may still be zero or near zero. Consider advertising and marketing expenses, for example. For a relatively large developer with a nontrivial marketing budget, the marginal cost associated with an additional user or an additional IAP purchase is likely

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[173] His model implies that the price depends on the marginal cost, see equation E.20, Appendix F, Rysman Report.

negligible. The same is true for wages and customer support, especially when the firm already has a sufficiently large volume of sales. Dr. Rysman argues that hosting and cloud computing costs also scale up with the number of users or usage, so they are also marginal costs.[174] However, he does not quantify such costs and nor show or even claim that they apply to every app. In fact, some developers may have excess infrastructure available, so that there would be no additional infrastructure costs associated with an additional user, IAP, or subscriber. Moreover, some apps do not require hosting or cloud computing at all.

130. When discussing marginal cost, Dr. Rysman does not distinguish between users and usage. I explain above that the incremental costs of acquiring a new user should be small for a sufficiently large developer. However, even for the case of a developer with a non-negligible cost of acquiring an additional user or install, the marginal cost of additional usage may still be negligible. Again, consider a game app that offers IAPs for digital items such as an energy boost, a level up, or in-App digital currencies. When a user purchases one *additional* unit of any of those items in app, the incremental cost is likely negligible. In fact, Mr. Sweeney, CEO of Epic Games, testified that the margical cost of V-Bucks is zero.[175] IAPs represent the large majority of sales through Google Play.

131. Some apps incur non-negligible marginal cost, such as when they incur content or IP licensing costs with one additional paid user or one additional IAP purchase.[176]

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[174] Rysman Report 571.

[175] Trial Tr. (Sweeney) at 190:12-16, *Epic Games, Inc. v. Apple, Inc.*, No. 4:20-cv-05640-YGR (N.D. Cal.): "Q. What does it cost to Epic to generate a V-Buck, minting a V-Buck? A. There is no cost to a V-Buck. There's cost in developing the software, but the V-Bucks themselves don't have a marginal cost."

[176] It is worth noting that the structure of the licensing costs also matters. If the developer pays a lump sum amount for the license, then an additional user or purchase would not create an incremental licensing costs.

132. Dr. Rysman, while trying to highlight the types of costs that can be marginal cost, completely ignores the heterogeneity among different developers and has not provided any evidence to show that (1) these costs are factored into developers' pricing decision, as his economic model implies or (2) even if some costs are marginal, they are relevant and applicable to every app. A case in point, according to deposition testimony of one of the named developer class plaintiffs, LittleHoots, [redacted][177]

133. In any event, as noted above, with alternative demand curves to the one chosen by Dr. Rysman, the service fee pass-through rate is positively related to marginal cost. Thus, if marginal cost is positive, but small, the pass-through rate can still be well below 100%. Moreover, with price points or other pricing frictions, the pass-through rate could be zero. Thus, Dr. Rysman's claim that marginal costs are "likely" positive does not by itself say anything about the pass-through rate. Dr. Rysman needs to layer on his demand curve assumption in order to get to the 100% pass-through rate and, again, that demand curve assumption is entirely unsupported.

C. Dr. Rysman's Variety Damages Calculation

1. Dr. Rysman's Variety Damages Calculation is Based on a Flawed Theoretical Model That Has Little Connection to Economic Reality

134. Dr. Rysman uses a highly stylized model to calculate what he claims are the damages to consumers from having fewer apps available in the actual world than they would have had in the but-for world (less "variety"). Dr. Rysman's model incorporates exactly two empirically determined figures—the own elasticity of demand for (paid) apps and the number of (paid) apps.

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[177] Ellis Dep. at 189: 9-193: 23.

All of the other features of Dr. Rysman's model are based on assumptions for which Dr. Rysman has offered no empirical support.

135. A highly stylized model such as Dr. Rysman's may be useful for qualitatively investigating theoretical questions. However, such a model will not be suitable for quantitatively assessing damages in a real-world context if it fails to incorporate economically important aspects of that real-world context. Dr. Rysman's model fails to incorporate almost any of the economically important aspects of the real world Android app store marketplace. Thus, the model provides a flawed and unsupported basis on which to calculate variety (or any other form of) damages.

a. Dr. Rysman's Model Does Not Account For Free and Ad-Supported Apps

136. Dr. Rysman's model addresses only the 465,262 apps on Google Play that are "paid" in some respect – paid download, IAP, or subscription. However, there are also 3,706,174 apps on Google Play that are either free or ad-supported (and thus free to consumers).[178] Dr. Rysman completely ignores the free and ad-supported apps.

137. This omission is problematic because some of the increased "variety" in paid apps that Dr. Rysman claims would have entered may in fact just have been apps switching from being free or ad-supported to being paid. That is, some developers of free or ad-supported apps may have chosen to convert these apps to paid in the but-for world if the service fee rate were lower. This is closely related to the concept of negative pass-through I discussed earlier. However, the increase in the number of paid apps resulting from such conversions would not represent an increase in

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[178] See the App Catalog data (GOOG-PLAY-001507601).

"variety" in the context of Dr. Rysman's model because those apps already existed as free or ad-supported apps. Dr. Rysman's model would mistakenly count them as "new" apps.

138. Indeed, whether the impact of converting an app from free or ad-supported to paid is positive or negative is not clear a priori and is not a question that Dr. Rysman's model can even address. Consumers who used an ad-supported app may prefer viewing ads to paying for the app. Dr. Rysman's model assumes away any such differences among consumers.

b. Dr. Rysman's Model Does Not Distinguish Between Download Price, IAP, and Subscription Price

139. Dr. Rysman's model assumes that each app generates revenue through the sale of a single "product" at a single "price." This is contrary to the workings of the actual marketplace. Many apps generate revenue through the sale of multiple products, such as the initial download and IAP. Other apps generate revenue through monthly subscriptions, which are different products than downloads or IAP. The demand curves, costs, or pass-through for these different products may well be different, but Dr. Rysman's model ignores these distinctions.

c. Contrary to All Evidence, Dr. Rysman's Model Assumes All Apps are the Same in Terms of Quality, Demand Function, Marginal Cost, Entry Cost, Price, and Quantity Sales

140. Dr. Rysman assumes that all apps have the same quality parameter, the same demand function, the same marginal cost, the same entry cost, the same price, and the same quantity sales. Without this "symmetry" assumption, Dr. Rysman's model would be unworkable. For example, in the absence of the symmetry assumption, Dr. Rysman would have to specify the distribution of quality, marginal cost, and entry cost across the various apps, including apps that did not enter in the actual world, but would in his but-for world. He did not even attempt to identify an empirical

method by which these distributions could be estimated. However, "workability" is not a justification for using a flawed model to calculate damages.

141. The symmetry assumption is obviously false with regard to price and quantity. Indeed, elsewhere in his report, Dr. Rysman recognized that apps are of different quality and the quality differences matter to consumer welfare.[179] Empirical evidence also shows that apps differ vastly in prices, quantity sales, and usage, as discussed below. Variation in price, quantity, and usage across apps suggests variation in quality, marginal cost, and demand function across apps.

142. Far from being the same, prices vary from $0.1 to $399.99 for paid apps and from $0.05 to $399.99 for IAPs and subscriptions, as shown in Google Play's transactions in May 2022.[180] The variation is further illustrated in Figures 14 - 17 below, which plot the list prices of paid downloads and IAPs (including subscriptions) for game apps and non-game apps transacted in May 2022 respectively, with the horizontal axis showing the price point of a given dot (e.g., $0.99, $1.99) and the vertical axis showing the total quantity sales associated with the price point.[181] It is clear from the graphs that there are *many* different price points across apps. Even zooming in to just the top apps in Google Play, as shown in Figure 18, there are rarely two apps that have the same price – for top paid game apps, prices vary from $0.99 for "Rovio Classics: Angry Birds" to $7.49 for "Minecraft," and for top paid non-game apps, prices vary from $0.49 for "Halloween Animated WatchFace" to $14.99 for "FL STUDIO MOBILE."

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[179] See, for example, Rysman Report ¶ 492 ("Imperfect predictability of app quality, before its entry mitigates concerns that only low-quality apps would enter after the reduction of commissions.")

[180] I look at the monthly average prices of paid downloads, IAPs, subscriptions in May 2022.

[181] Since paid apps, IAPs, and subscriptions transacted in May 2022 may be a subsample of all the paid apps, IAPs, and subscriptions, the variations shown here may still under-represent the price variations across all the paid apps, IAPs, and subscriptions.

Figure 14. Prices of Paid Downloads Transacted in May 2022 - Games

[redacted]

Source: See Exhibit 9a.

Figure 15. Prices of Paid Downloads Transacted in May 2022 – Non-Games

[redacted]

Source: See Exhibit 9b.

Figure 16. Prices of IAPs and Subscriptions Transacted in May 2022 - Games

[redacted]

Source: See Exhibit 10a.

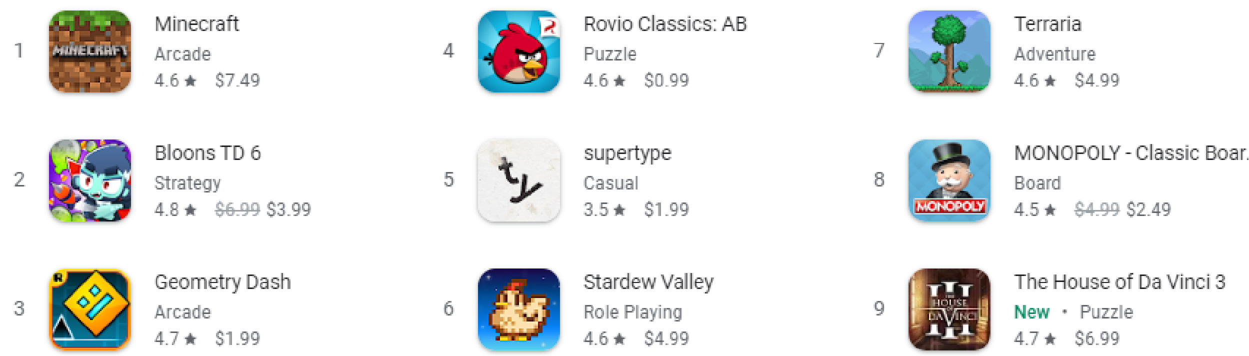
Figure 17. Prices of IAPs and Subscriptions Transacted in May 2022 – Non-Games

[redacted]

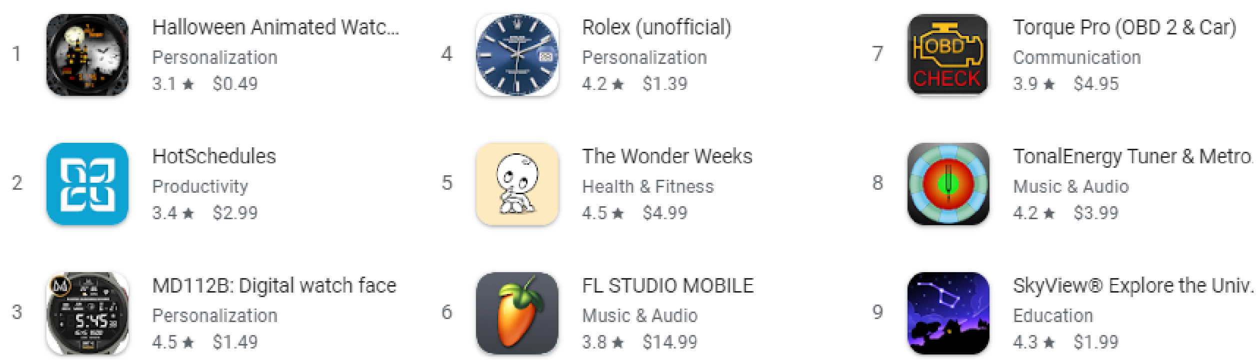
Source: S[redacted]

Figure 18. Prices of Top Paid Apps in Google Play on October 30, 2022

Game Apps



Non-Game Apps



Source: https://play.google.com/store/apps accessed on October 30, 2022.

143. Quantity sales also vary greatly for paid apps and IAPs and subscriptions.[182] Based on Google Play's transactions in May 2022, the monthly quantity sales of paid downloads in this month range from 1 to 66,169 for games and 7,773 for non-games. For example, in May 2022, the game app [redacted]" priced at $1.99, only had one purchase, the game app [redacted] priced at $5.99, had 100 purchases, and the game app [redacted] priced at $7.49, had 66,169 purchases. As further shown by the distribution of quantity sales in May 2022 in Figures 19 and 20, quantity sales scatter at all different values between 1 and the largest quantity sales. Again,

[182] I look at quantity purchased of paid downloads in May 2022 using Google Play's transactions data.

this clearly shows that there is large variation in the quantity of sales across apps, which is not consistent with "symmetry" in app quality and consumer demand.

Figure 19. Quantity Sales of Paid Apps Transacted in May 2022 - Games

[redacted]

Source: See Exhibit 11a.

Figure 20. Quantity Sales of Paid Apps Transacted in May 2022 - Non-Games

[redacted]

Source: See Exhibit 11b.

144. App usage also varies greatly. Based on App Annie data, among apps with non-zero usage, the monthly hours spent on apps range from almost zero to more than 1 billion hours. For example, as shown in Figure 22, the total time spent on [redacted] in September 2021 exceed [redacted] hours, while the total time spent on the app [redacted] (a game app for kids) are only 0.09 hours, i.e., less than 6 minutes in total from all the U.S. users. There are also apps with zero usage. Again, this clearly shows that there is large variation in usage across apps, which is not consistent with "symmetry" in app quality and consumer demand.

Figure 21. Monthly Hours Spent on Apps

[redacted]

Source: See Exhibit 12.

Figure 22. Usage (Total Hours Spent) of Selected Apps in September 2021

[redacted]

Source: See Exhibit 13.

145. Another implication of the symmetry assumption is that, within Dr. Rysman's model, each app that offers either paid download, IAPs, or subscriptions is assumed to compete to the same degree with each of the other 465,262 paid apps. Again, this assumption is obviously false. The economic reality is that an app competes much more closely with other apps of the same "type" than it does with apps of other types. For example, Spotify competes with other music streaming apps, but likely does not compete at all with many other types of apps, such as weather apps. In fact, studies recognize the importance of app developers being able to "effectively and efficiently identify competitor apps," which can be challenging because there are a large number of apps and they are not all competing equally which each other.[183] Many studies apply complex models to

[183] Uddin, Kafil M., Qiang He, Jun Han, and Caslon Chua, "App Competition Matters: How to Identify Your Competitor Apps?" IEEE International Conference on Services Computing (2020), pp. 370-377.

identify competitor apps based on app characteristics.[184] Economic studies also find that highly-rated apps (or the superstar apps) differ significantly from low-rated apps in terms of app characteristics and competitiveness.[185] Finally, the economics research paper that Dr. Rysman relies upon for a key parameter of his model itself uses a demand structure that allows a given app to compete more closely with some apps than others.[186] Thus, Dr. Rysman's model is inconsistent with the source for one of its key parameters. Accounting for product differentiation (segmentation) in apps has important implications for the effects of entry of new apps in the but-for world. Entry of a new music streaming app could have very different effects on consumers than entry of a new weather app. If Dr. Rysman's symmetry assumption were discarded, he would be forced to grapple with the difficult questions of what types of apps would enter and what effects these various new apps would have.

146. The symmetry assumption is also false with respect to marginal costs and cost of entry. As noted above, Dr. Rysman claims certain app developer costs are marginal costs. Yet, the size of these costs vary across apps, indicating that—contrary to Dr. Rysman's assumption—not all apps

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[184] See, for example, Al-Subaihin, Afnan A., Federica Sarro, Sue Black, Licia Capra, Mark Harman, Yue Jia, and Yuanyuan Zhang, "Clustering mobile apps based on mined textual features," In Proceedings of the 10th ACM/IEEE international symposium on empirical software engineering and measurement, 2016, pp. 1-10; Chen, Ning, Steven CH Hoi, Shaohua Li, and Xiaokui Xiao, "SimApp: A framework for detecting similar mobile applications by online kernel learning," In Proceedings of the eighth ACM international conference on web search and data mining, 2015, pp. 305–314.

[185] See S. Comino, et al., "Updates management in mobile applications: iTunes versus Google Play," *Journal of Economics & Management Strategy,* 28 (2019), pp. 392-419; Lee, Gunwoong, and T. Santanam Raghu. "Determinants of mobile apps' success: Evidence from the app store market," Journal of Management Information Systems Vol. 31, No. 2, 2014, pp. 133-170; Yi, Jisu, Youseok Lee, and Sang-Hoon Kim. "Determinants of growth and decline in mobile game diffusion." Journal of Business Research Vol. 99, 2019, pp. 363-372.392-419.

[186] See Ghose, Anindya and Sang Pil Han, "Estimating Demand for Mobile Applications in the New Economy," *Management Science*, Vol. 60, No. 6, 2014, at p. 1475. Ghose and Han use the random coefficient nested logit model, where apps are grouped by different nests, i.e. app categories such as games, media, lifestyle, etc. Consumers see apps from the same nest as closer substitutes compared to the apps from other nests. Dr. Rysman, in contrast, does not account for app categories and assumes all apps are the same substitutes for each other.

have the same marginal cost. The cost of developing an app varies by many factors, such as level of complexity, app type, and development approach. According to Net Solutions, a technology company that helps business build mobile apps and other types of digital products, the development cost in 2022 ranges from $40,000 to $60,000 for simple apps (such as a calendar app), $61,000 - $150,000 for average apps (such as McDonald's Loyalty App), and $300,000 and above for complex apps (such as Uber and Instagram).[187] The cost can also depend on the development approach – for example, the app development cost ranges from $60,000 to $75,000 with hiring a local agency, $85,000 or higher with having an in-house team, and from $10,000 to $25,000 with hiring a freelancer.[188, 189]

147. Dr. Rysman claims that his symmetry assumption is justified because ex ante (before any app has been introduced to the market), the success of an app is uncertain and therefore all apps can be thought of as being indistinguishable.[190] While it is true that app success is ex ante less than perfectly predictable, that does not imply that all apps have the *same* level of expected success

[187] "How Much Does it Cost to Build an App [A Complete Breakdown]," Net Solutions, October 21, 2022, https://www.netsolutions.com/insights/cost-to-build-an-app/. There are many other estimates from app development companies, technology consultancy agencies, and economics studies. For example, another source shows that the cost for developing simple apps would range from $12,960 to $30,240, from $34,560 to $60,480 for compelx apps, and from $56,160 to $82,080 for advanced apps. See Nathan Sebastian, "How Much Does It Cost to Develop an App? | GoodFirms Survey," https://www.goodfirms.co/resources/cost-to-develop-an-app. The key point is that all of these show that (1) app development cost varies widely across apps; and (2) the range include figures that are far below or above from Dr. Rysman's estimate for the fixed cost of $20,959.

[188] "How Much Does it Cost to Build an App [A Complete Breakdown]," Net Solutions, October 21, 2022, https://www.netsolutions.com/insights/cost-to-build-an-app/.

[189] Dr. Rysman's model estimates the fixed cost of entry to be approximately $21,000. This is only half the low end of the range for "simple apps" and is an order of magnitude below the low end of the range for "complex apps." Thus, this prediction of Dr. Rysman's model is inconsistent with the actual market facts.

[190] For example, Dr. Rysman tries to justify the common marginal cost assumption by resorting to this type of uncertainty, see Rysman Report ¶ 572 ("In my model, I assume that all developers have the same marginal cost c. That assumption is natural if firms set prices before learning their marginal cost. In that case, the interpretation of the marginal cost in my model is that it is an average marginal cost, which is an approximation to the reality in which developers have some uncertainty about various features of the market, including whether their app will be successful.")

ex ante, which is what Dr. Rysman is claiming. In fact, market participants regard different apps as having different levels of expected success. For example, venture capital investors and mobile app publishers forecast the success of an app using multiple approaches and KPIs and use such forecasts to decide on the levels of funding for the app.[191] Economics studies find that success is not unpredictable – even for young entrepreneurs with limited history of success, the probability of future success is positively correlated with factors such as being funding by more experienced venture capital firms; and more experienced venture capitalists are able to identify and invest in first time entrepreneurs who are more likely to become serial entrepreneurs.[192] Additionally, game developers use knowledge of past game life cycles and game KPI data to forecast future performance and decide on marketing, development, and pricing strategy.[193] Although these forecasts are not crystal balls and are sometimes revised, they are informed by data such as franchise popularity, game genre, and pre-launch marketing and testing.[194] Moreover, economic studies also find that app success is correlated with and thus can be predicted by a variety of factors, such as the app developers' app portfolio management and past success, potential competition faced by the newly-launched apps, and app charactertistics.[195] Dr. Rysman assumes app success

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[191] See, e.g., "The metrics we use to predict mobile app growth," Anna Baidachnaya, Head of Sales, Europe, Braavo Capital, December 18, 2019, available at https://www.linkedin.com/pulse/metrics-we-use-predict-mobile-app-growth-anna-baidachnaya/.

[192] Gompers, Paul, Anna Kovner, Josh Lerner, and David S. Scharfstein. "Skill vs. luck in entrepreneurship and venture capital: Evidence from serial entrepreneurs." NBER Working Paper (2006).

[193] See, e.g., "Rovio: Extensive report," *inderes*, September 6, 2022, pp. 8-18; "Capcom Announces Revision of Consolidated Full-Year Earnings Forecast," Capcom press release, April 21, 2022 .

[194] See, e.g., "Rovio: Extensive report," inderes, September 6, 2022, pp. 8-18; "Capcom Announces Revision of Consolidated Full-Year Earnings Forecast," Capcom press release, April 21, 2022.

[195] For example, Picoto et al. (2019) analyzed what factors influence the mobile app's success and found that factors such as user rating, category popularity, diversity as measured by the number of languages supported, package size, and release date are all determinants of an app's success and would increase the probability that an app will be ranked inside the top 50. Lee and Raghu (2014) provides empirical evidence to show the app developers' app portfolio management influences success in the App Store and a variety of factors app-level characteristics,

is completely unpredictable for all apps. He does not assess the robustness of his results to allowing for some predictability, likely because his model would become unworkable under this much more realistic assumption. Different levels of expected success is also demonstrated by app developers initially setting app pricing at different levels. For example, game developers view price as a function of expected value of the product, which can be inferred by factors such as developer reputation and established player base. A small game developer states that "if Jon Blow comes out with a $99 game, people would line up to buy it. If I did it, no one would buy it. Reputation plays a role here."[196] Another game developer states that "[i]t's very easy to say 'well, just price it higher', but unless you have an established fanbase that already deeply understands the value of your work, there's very little argument to make in favor of pricing your game up."[197] Economic studies also find that digital video game consumers consider high price an indicator of superior product quality and therefore higher prices are in fact associated with higher sales.[198]

148. Moreover, the real world is dynamic, not static as in Dr. Rysman's model. Thus, in contrast to Dr. Rysman's model, a real-world app developer can adjust the prices or change monetization

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including ratings, market age, early entrant advantage, and price, also correlate with app survival on the top charts in the app store using data from Apple's App Store. Kajanan et al. (2012) shows that a variety of factors, such as number of competing apps in the same category, how many app categories an app is placed in, frequency of app updates, and promotion activities, can all be used to predict whether a newly-launched app will take off upon launch, survive, and enjoy sustained success. See Lee, Gunwoong, and T. Santanam Raghu. "Determinants of mobile apps' success: Evidence from the app store market." Journal of Management Information Systems 31, no. 2 (2014): 133-170; Kajanan, S., Pervin, N.,Ramasubbu, N.,Dutta, K., Datta, A., "Takeoff and sustained success of apps in hypercompetitive mobile platform ecosystems: An empirical analysis," International Conference on Information Systems, ICIS 2012 3: 1850-1867. Picoto, Winnie Ng, Ricardo Duarte, and Inês Pinto. "Uncovering top-ranking factors for mobile apps through a multimethod approach." *Journal of Business Research* Vol. 101, 2019, pp. 668-674.

[196] https://www.gamesindustry.biz/indie-game-pricing-more-art-than-science.

[197] https://www.gamesindustry.biz/indie-game-pricing-more-art-than-science.

[198] See Choi, Hoon S., Myung S. Ko, Dawn Medlin, and Charlie Chen. "The effect of intrinsic and extrinsic quality cues of digital video games on sales: An empirical investigation." Decision Support Systems 106 (2018): 86-96.

strategies[199] for an app once success is known. By lumping paid downloads, IAPs, and subscriptions together, Dr. Rysman ignores important distinctions between them. IAPs can be added to an existing app over the app's lifecycle. The price for such IAPs will be set ex post and thus will reflect the underlying asymmetry among apps, contrary to Dr. Rysman's claim. I note that IAPs (including subscriptions) make up about 98.5% of sales quantity. Moreover, many apps are follow-ups to earlier apps that allow for pricing with a better sense of expected success based on the earlier app, and many IAPs are add-ons to existing apps for which the level success is well-understood.[200] The latter point also applies to marginal cost. Developers with prior app development experiences will have a better sense of what a new app's marginal cost will be than a first-time developer. Dr. Rysman's assumption that every app is associated with the same amount of uncertainty and that no app is distinguishable from another ex ante is inconsistent with economic reality.

149. Dr. Rysman cited a recent unpublished working paper on the effect of the General Data Protection Regulation (GDPR) in the EU on the entry of new apps to support his position that app success is unpredictable.[201] Specifically, the study's conclusion is based on the following empirical observation: expecting the GDPR raises the entry costs which could lead to fewer entries, the authors find that the number of ex-post successful apps that entered the Google Play store after GDPR went into effect indeed has declined but it declined by roughly the same percentage as *all*

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[199] For example, Tinder was launched as a completely free app, and only introduced a monetization strategy (subscriptions for premium content) once it was highly successful.

[200] In his theoretical model, Dr. Rysman does not distinguish between a paid download and IAPs. Yet, the ability to predict success of a new IAP for an existing app would likely be greater than for a new app in general.

[201] Rysman Report ¶ 572 ("A recent paper by Janßen et al., which uses data on apps in the Google Play store to study the effect of the General Data Protection Regulation ('GDPR') in the EU on entry of new apps and innovation, finds 'strong evidence that app success is unpredictable.'")

new apps. The authors reason that had app success been predictable, one would expect the ex-post successful apps to decline *less* than all apps as a whole Therefore, the empirical observation above suggests that app success is unpredictable.[202]

150. There are several reasons why this study in fact does not support Dr. Rysman's extreme assumption in this case. First, the study included all apps the authors were able to collect from Google Play store, free, ad-supported, paid, subscription or IAP-based. Dr. Rysman's model, however, completely ignores free and ad-supported apps, which are the large majority of the apps in Google Play store. Because the Janßen, et al. (2022) study did not perform any targeted study on paid apps or apps with IAPs, there is no analogous evidence for the apps Dr. Rysman focused on exclusively. Second, the authors of the study noted that their results did suggest partial predictability rather than complete unpredictability of app success and went on to assess the robustness of their findings under partial predictability.[203] In contrast, Dr. Rysman failed to assess how robust his damages calculations would be under partial predictability. Third, GDPR is a different type of market intervention than a reduction in service fee rate and therefore the findings based on GDPR do not necessarily extend to the but-for world for the Google Play store. For example, in the but-for world in this case claimed by Plaintiffs, Google would face more competition and charge lower uniform service fee rates. GDPR, however, introduced a much more uncertain environment. The study made it clear that some developers, while understanding the

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[202] Note that the authors of the study did not have the complete data on apps and their entry dates, and therefore had to perform various forms of data manipulation to circumvent data limitations. Rebecca Janßen, Reinhold Kelser, Michael E. Kummer, and Joel Waldfogel, GDPR and the Lost Generation of Innovative Apps, NBER Working Paper, May 2022 (hereafter, Janßen et al (2002)). It is also worth noting that the authors's findings are not conclusive regarding predictability. See Table 2.

[203] Janßen et al, (2022), p. 32 ("Our basic descriptive estimate provides reasonable evidence that app success is unpredictable….But the descriptive results on the decline in entry of successful apps – in columns (2) and (3) of Table 2 – Suggest partial predictability.").

substantial cost of non-compliance, did not know what to do to comply with GDPR.[204] Thus, GDPR increased uncertainty for many developers, which was not the case with the lower service fee rates of the but-for world. Uncertainty coupled with the penalty structure of GDPR may drive out both ex-post successful and ex-post unsuccessful apps, even if app success is predictable. Because violating GDPR could result in fines to developers up to a *proportion* (4%) of annual revenue (or 20 million EUR, whichever is larger),[205] if app success is in fact predictable, uncertainty related to compliance can drive out precisely the predictably successful apps.

151. Dr. Rysman's symmetry assumption is central to his analysis of the damages associated with the increased number of apps that he claims would have existed in the but-for world. In assuming that all apps are symmetric—both the apps that existed in the actual world and the additional apps that would have entered in the but-for world—Dr. Rysman is assuming that there is nothing special or different about the actual world apps as compared to the additional but-for apps. Specifically, under Dr. Rysman's model, any of the actual world apps could have been switched out with any of the additional but-for apps without having any effect on consumers in the actual world because of the assumption that the latter are no worse than the former as far as consumers are concerned. This assumption makes little sense in the context of the real world. In fact, one would expect that apps that did not enter in the actual world are different from the apps that did enter (i.e., the symmetry assumption is wrong). Specifically, one would expect that apps that did not enter were, on average, of lower quality, had lower expected demand, or had higher costs than the apps that did enter. In short, in the actual world the best apps entered and lower-

[204] Janßen et al. (2022) discussed their survey answers to the questions regarding challenges and costs associated with GDPR, finding that "the three most prevalent challenges are administrative burdens (86%), additional costs (47.5%), and a lack of knowledge about the regulation's details (36.9%)." p. 45.

[205] See "Fines/Penalties," GDPR, https://gdpr-info.eu/issues/fines-penalties/.

quality apps did not. In that case, the additional but-for apps (pulled from the lower-quality apps that did not enter in the actual world) likely would offer less consumer value on average than the actual world apps, contrary to Dr. Rysman's symmetry assumption.[206] In fact, elsewhere in his report, Dr. Rysman concedes that it is possible that entry could very well have been by low quality apps and provides reasons why "concerns that only low-quality apps would enter after the reduction of commissions" are mitigated.[207] But what Dr. Rysman also failed to recognize is that low quality apps are not just those with a small but positive quality but could also include apps that are malicious. In fact, Google spent large amount of resources and money on app screening to ensure app quality.[208] Such apps that escape app stores' review would lower consumer welfare. Thus, Dr. Rysman's symmetry assumption leads to an overstatement of damages.

152. In Appendix E, I demonstrate how incorrectly applying Dr. Rysman's symmetric model to a situation that is actually asymmetric can lead to substantial overstatements in the "variety" damages calculation.

153. Dr. Rysman states that "[a]nalyzing or quantifying the preferences for and benefits of variety…is common in the literature."[209] Yet, the papers in the literature do not make the

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[206] For example, a higher profit app would have a lower own elasticity of demand, which in turn would generally be associated with greater consumer value (consumer surplus) than a lower profit app.

[207] Rysman Report ¶ 492.

[208] Google Play periodically removes apps which are low-quality, abandoned, violate copyright, or are potentially malicious. See, e.g., "Google to remove nearly 900,000 abandoned apps from Play Store," *Business Standard*, May 15, 2022, https://www.business-standard.com/article/companies/google-to-remove-nearly-900-000-abandoned-apps-from-play-store-122051500521_1.html; "Google removes apps for secretly copying phone numbers," *BBC News*, April 8, 2022, https://www.bbc.com/news/technology-61023379; "How Google Fights Piracy," November 2018, https://www.blog.google/documents/27/How_Google_Fights_Piracy_2018.pdf/, pp. 51-54. Google Play's content moderation investment includes Google Play Protect, which utilizes a multi-step automated and human review process to remove potentially harmful applications. "Cloud-based protections," developers.google.com/android/play-protect/cloud-based-protections.

[209] Rysman Report ¶ 561.

unrealistic assumptions that Dr. Rysman does here. In fact, both the CES model and logit model have been criticized in the academic literature because of the restrictions they impose on the substitution patterns between products, a result of the independence of irrelevant alterantives (IIA) property that both models possess. The IIA restrictions on substitution patterns can be especially misleading in the context of new product introduction. Under a model with the IIA property, when a new product is introduced, consumers are assumed by the model to switch to the new product from incumbent products proportionally, rather than from each incumbent product depending on how similar the new product is to that incumbent product in terms of product characteristics. For example, Hausman (1996) points out this problem with the CES model in his paper on the cereal industry:

> The so-called symmetry [IIA] property seems a poor guide to empirical reality, where I know that Apple-Cinnamon Cheerios are a much closer substitute to Honey-Nut Cheerios than they are to Nabisco Shredded Wheat or to Total.[210]

154. A more recent academic publication also discusses the shortcomings of models with the IIA property, such as the CES model, noting that the implied consumer "preferences lack flexibility because the elasticity of substitution is constant and the same across varieties."[211] Regarding Dr. Rysman's representative consumer model, Nevo (2000) states that "the required assumptions are strong and for many applications seem to be empirically false. The difference between an

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[210] Hausman, J. A. (1996). Valuation of new goods under perfect and imperfect competition. In *The economics of new goods* (pp. 207-248). University of Chicago Press.

[211] Zhelobodko, E., Kokovin, S., Parenti, M., & Thisse, J. F. (2012). Monopolistic competition: Beyond the constant elasticity of substitution. Econometrica, 80(6), 2765-2784.

aggregate model and a model that explicitly reflects individual heterogeneity can have profound affects on economic and policy conclusions."[212]

d. Dr. Rysman's Model Predicts That There Would Be a Large Number of Additional Apps in the But-For World, But Dr. Rysman is Unable to Identify Any Specific App or Developer That Was Inhibited From Developing Such an App

155. For Dr. Rysman's variety damages calculation (where zero pass-through to consumer prices is assumed), Dr. Rysman's model predicts that there would have been 338,993 more apps that offer paid downloads, IAPs, or susbcrptions in the but-for world than in the actual world, a 72.9% increase in the number of such apps. According to Dr. Rysman, this leads to about [redacted] for consumers in the Plaintiffs states during the class period.[213]

156. Dr. Rysman does not describe what these apps would have been or which developers would have created them. He provides no evidence that there was a pent-up supply of apps that would have been released if only the service fee rate had been 15% instead of 30%. He has no evidence from any developer about if and to what extent the service fee plays a role in entry decisions. In fact, after the July 2021 Google Play service fee rate reduction, there was no observable spike in either the number or the growth rate of apps that offer paid downloads, IAPs, or subscriptions and incurred sales (based on Google Play's transactions data). See Figures 23-24.

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212 Nevo, A. (2000). A practitioner's guide to estimation of random-coefficients logit models of demand. Journal of economics & management strategy, 9(4), 513-548, p 515.

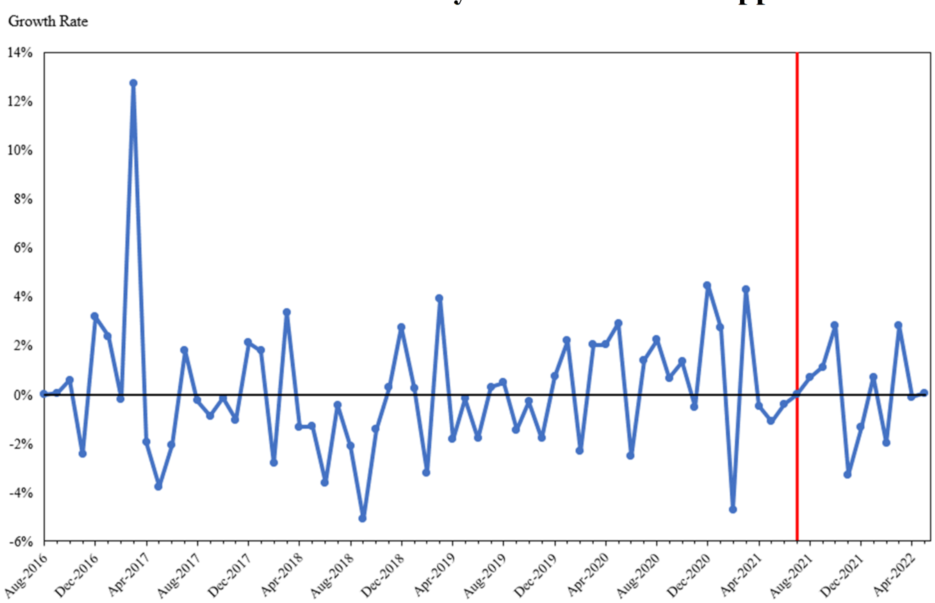
213 Rysman Report Exhibit 74.

Figure 23. Monthly Total Number of Apps with Non-Zero Sales

[redacted]

Source: See Exhibit 15a.

Figure 24. Growth Rate of the Monthly Total Number of Apps with Non-Zero Sales



Source: See Exhibit 15b.

D. Dr. Rysman's Hybrid Overcharge/Variety Damages Calculation is Flawed and Unsupported

157. Dr. Rysman performs a hybrid calculation that allows both the service fee rate and the number of apps to be different in the but-for world than in the actual world. He again assumes a 15% but-for service fee rate and uses his theoretical model (which builds in a 100% pass-through rate) to calculate damages that combine effects from increased variety and lower consumer prices in the but-for world. Because this calculation effectively uses the same inputs and approaches as Dr. Rysman's overcharge and variety damages calculations, it suffers from the same flaws and is unsupported for the same reasons as those discussed above.

VIII. Dr. Rysman and Dr. Singer Ignore Increased Costs to Consumers and Developers in the But-for World

158. Dr. Rysman claims that, in the but-for world, there would have been many more paid apps and potentially more app stores and these additional paid apps would have led to a substantial increase in consumer welfare. Using his highly stylized model, he quantifies the loss in consumer welfare due to this "variety effect." Dr. Singer similarly argues that there would be additional app stores that compete against Google in the but-for world and quantifies (1) the effect of an allegedly lower Google Play store service fee rate on the prices and the quantity purchased and (2) the additional consumer subsidies that Google Play store would have offered. In all of these damages claims, both Dr. Rysman and Dr. Singer assume that Google Play is the only market player who would have changed its business conduct leading to unambiguous effect on consumers. Their assumption fails to properly take into account the distinct possibility that both consumers and developers would have faced increased costs in the but-for world. The impact of increased costs on consumer welfare, which I discuss in detail below, is intuitively clear. For developers, under Dr. Rysman's damages theory, the increased costs would have reduced entries/new apps in the

but-for world, directly countervailing Dr. Rsyman's variety effect. Neither Dr. Rysman nor Dr. Singer properly considered these additional costs, which led them to overstate the damages.

159. First, consider the consumers. In both Dr. Singer's and Dr. Rysman's but-for world where there would have been many more paid apps and more app stores, one would expect that consumers would have had to spend more time searching to identify the set of apps to download to their phones. Economic studies have shown that consumers face search cost when using smartphones to find apps. For example, Ghose, Goldfarb, and Han (2013) find that smaller screen size of mobile phones increases cost to user of browsing for information; furthermore, they find that ranking effects are higher on mobile phones, which suggest that search cost is higher on mobile phones, for example, links that appear at the top of the screen are especially likely to be clicked on mobile phones and stores located in close proximity to a user's home are much more likely to be clicked.[214] Lee et. al. (2020) states that "[t]he mobile applications (apps) market is one of the most successful software markets. As the platform grows rapidly, with millions of apps and billions of users, search costs are increasing tremendously."[215] These increased search costs in the but-for world would be an offset to damages. Yet, Dr. Rysman's model, as well as Dr. Singer's, assumes consumers have perfect information about every app in the market and that search is costless for consumers and thus entirely ignores this offset, thereby overstating damages. The existence of consumer search costs can also reduce the service fee pass-through rate, see Appendix E.

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[214] Ghose, Anindya, Avi Goldfarb, and Sang Pil Han, "How is the mobile Internet different? Search costs and local activities." *Information Systems Research* Vol. 24, No. 3, 2013, pp. 613-631.

[215] Lee, Gene Moo, Shu He, Joowon Lee, and Andrew B. Whinston. "Matching mobile applications for cross-promotion." Information Systems Research 31, no. 3 (2020): 865-891.

160. Dr. Rysman also ignores that many apps exhibit direct network effects—the value of the app to a consumer increases with the number of other consumers that use the app. Examples are dating apps and certain games. In Dr. Rysman's but-for world where there would have been more apps, the number of consumers using each app that existed in the actual world could have been lower than in the actual world. For apps that exhibit direct network effects, these apps would have delivered less value to consumers in the but-for world than the actual world. This reduction in value would be an offset to Dr. Rysman's "variety" damages. See Appendix E.

161. Now, consider the developers. Developers who would have multi-homed in the but-for world would have incurred additional costs related to separate app store applications, negotiations, different compliance requirements, different versions of Android systems (especially if that means different programming languages or substantively different versions of the same programming languages need to be used), among others. Based on Dr. Rysman's theory, these additional costs would have led to less entry (because it would be more costly for developers) and thus less "variety" than in Dr. Rysman's but-for world.[216] By ignoring the increased costs for developers in the but-for world, Dr. Rysman overstates the "variety" effect. While Dr. Rysman acknowledges the additional "technical barriers and financial requirements" developers would have had faced in the but-for world when multi-homing, he downplays the significance of these costs and argues that developers would have strong incentive to multi-home and in fact would have done so.[217]

[216] As the article that Dr. Rysman cited argues, "[f]actors reducing entry costs deliver large welfare benefits, while factors hindering entry – such as GDPR – can deliver substantial welfare losses." Janßen et al. (2002), p. 37.

[217] Rysman Report ¶ 158 ("Nonetheless, I find that technical barriers and financial requirements would not inhibit developers from multihoming. While there are some technical barriers to making Android apps available on different distribution channels, the 'similarities in the source code between different Android Os' means it is relatively easy for developers to modify an app to ensure its functionality on various Android smart mobile devices. While developers may also need to pay a fee for every additional app store on which they publish their app, such one-time fees are modest or even free. For example, the Google Play Store charges a one-time

According to both Dr. Rysman and Dr. Singer, so would consumers, presumably due to alternative stores being "side by side" on the home screen of mobile devices and developers' setting lower prices on alternative stores.[218] Lack of actual evidence of consumer multi-homing in the but-for world, Dr. Rysman and Dr. Singer cannot rule out that many consumers would still have chosen to single home even in the but-for world (for example, due to consumer search costs discussed above). In such a but-for world, there would not have been a single app store where a developer could reach all consumers. Consequently, even according to Dr. Rysman, it is important for developers to multi-home because "[e]conomic theory suggests that the incentives for agencts on one side to multi-home are inversely related to the measure of agents who multi-home on the other side of a platform"[219] and therefore, "[a]pp developers want to reach as many device users as possible… Multi-homing is especially important for apps that facilitate interactions among users, such as apps with a social networks component."[220] In other words, Dr. Rysman's arguments support the conclusion that additional costs due to the strong incentive to multi-home would be

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developer fee of USD $25, while the Samsung Galaxy Store is free of charge for developers."). Note that Dr. Rysman considered only a subset of incremental costs. They are also based on the actual world. He does not explain why one would expect the same in the but-for world. See also Rysman Report ¶ 159 ("Therefore, I find that, in the world absent Google's challenged restrictions, developers would be more incentivized to distribute their apps via alternative distribution methods that offer them a higher share of the revenues on app sales and in-app purchases and to multi-home across several distribution methods.")

[218] Singer Report ¶ 176 ("A developer can take advantage of multi-homing by discounting the price of its Apps to "steer" consumers to use the lower-cost platform.") and ¶ 283 ("In the context of this case, multi-homing exists to the extent consumers have App stores side-by-side on their mobile phone's home screens (if Google's conduct did not prevent consumers from having multiple App stores)—the adjacent placement is necessary so that multihoming is equally convenient for consumers. When two platforms are sufficiently close substitutes in the eyes of buyers and sellers, multi-homing can lead to competitive outcomes that benefit both buyers and sellers."). Rysman Report ¶ 159 ("Finally, given the likelihood that consumers use multiple distribution channels, developers would have a further incentive to actively promote the distribution of their apps via alternative platforms (or via sideloading), for example by offering lower prices for their apps or its in-app content to their consumers.") Dr. Rysman does not quantify "the likelihood that consumers use multiple distribution channels."

[219] Rysman Report Fn 61.

[220] Rysman Report ¶ 192.

inevitable. By failing to take into account these incremental costs, Dr. Rysman overstates his variety damages.[221]

IX. THE PLATFORMS IDENTIFIED BY DR. SINGER AND DR. RYMAN ARE UNSPPORTED BENCHMARKS FOR GOOGLE PLAY'S BUT-FOR SERVICE FEE RATE

162. Both Drs. Singer and Rysman tried to justify their but-for service fee rates by comparing them to various "benchmarks." However, a prerequisite for a valid benchmark analysis is that the potential benchmark is similar in its economic characteristics to the "target." The service fee rate that a two-sided platform charges depends on a number of economic characteristics such as the demand elasticities on both sides, the user installed base (reflecting indirect network effects), and competitive conditions.[222] Neither Dr. Singer nor Dr. Rysman present any evidence that their claimed benchmarks are appropriate or informative for Google Play. For easy reference, Table 9 shows the benchmarks that Drs. Singer and Rysman proposed.

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[221] Dr. Singer responded to a similar critique in his Class Rebuttal Report. First, as noted above, he argues that developers do not need to multi-home to benefit from increased competition. Singer Class Rebuttal Report ¶¶ 62-63 ("the mere threat of developers defecting to a competing platform, combined with actual defection (and steering) by other developers, would spur Google to decrease its take rate, in order to keep as many developers as possible on its platform.") Then, like Dr. Rysman, he argues that Dr. Burtis "provides no evidence that the incremental benefits of substantially and permanently lower take rates would be eliminated by the (presumably modest) incremental costs associated with operating on multiple app stores (all of which would be Android-compatible). Therefor, Dr. Singer appears to acknowledge that such incremental cost may exist but disputes its significance. While certain developers may be content with single homing, Dr. Singer cannot rule out that some will have to incur additional costs, especially in a but-for world where customers single home. Neither Dr. Singer nor Dr. Rysman rule out such a but-for world. Despite claiming such costs are "presumably small," Dr. Singer presented no evidence to that effect.

[222] Rochet and Tirole (2003); Rochet, Jean-Charles, and Jean Tirole , "Two-Sided Markets: A Progress Report," *The RAND Journal of Economics*, Vol. 37, No. 3, 2006, pp. 645-667; Hagiu, Andrei, "Pricing and commitment by two-sided platforms," *The RAND Journal of Economics*, Vol. 37, No. 3, 2006, pp. 720-737.

Table 9. Benchmarks Proposed by Drs. Singer and Rysman

Category	Benchmark	Service Fee Rate	Proposed by Dr. Singer	Proposed by Dr. Rysman
Alternative Android App Stores	ONE Store	5-20%	Yes	Yes
	Aptoide	10-25%	Yes	Yes
	Amazon Appstore	18%	Yes	Yes
	Galaxy Store	30%	No	Yes
	Game Jolt Store (Mobile)	0 to 10%	No	Yes
PC App Stores	Microsoft	5% for non-game and non-Xbox apps 0% for non-game PC apps if apps utilize its own or a 3P payment system	Yes	Yes
	Chrome Web Store	5% if using Chrome Web Store API 30% for in-app payments for ARC apps	Yes	Yes
	Game Jolt Store	0-10%	No	Yes
PC Game Platforms	Microsoft (Game)	12% for PC games 30% for Xbox console games [1]	Yes	Yes
	Steam	20-30%	Yes	Yes
	Epic Games Store	12% for all games	Yes	Yes
	Discord	10%	Yes	Yes
Other Two-Sided Platforms	Substack (Online publishing platform)	10% + credit card fee	Yes	No
	Revue (Online publishing platform)	5%	Yes	No
	Amazon	8%-15% + $0.99/item or $39.99/month	Yes	No
	eBay	12.55% + $0.35	Yes	No
	Etsy	8% + $0.45	Yes	No

Source: See Exhibit 16.

163. Dr. Singer argues that his claimed but-for Google Play service fee rate of 22.2% generated by his app distribution market model is corroborated by "similarly situated, two-sided digital platforms." By "similarly situated" platforms, Dr. Singer appears to refer to those platforms "where there are no (or fewer) anticompetitive restraints similar to those imposed by Google in the instant case, and the fundamentals of platform economics (connecting two sides of a market) are present."[223] Dr. Singer provides a list of platforms including ONE Store in Korea, Aptoide,

[223] Singer Report ¶ 307.

Amazon Appstore, Steam, Epic, Microsoft, PC App store, online retail stores, and even online publishing. The two conditions Dr. Singer identifies (no anticompetitive restraints and, generically, being a platform) are hardly sufficient to ensure comparability, as different platforms can vary widely in their supply and demand characteristics. Therefore, Dr. Singer has failed to demonstrate that any of these platforms are "similarly situated" to Google Play along any supply and demand dimension (other than the mere fact of being platforms). To the contrary, there are many reasons that suggest that these other platforms are not appropriate benchmarks for Google Play in the but-for world. To be clear, assessing the comparability of these other platforms with Google Play is a distinct exercise from defining the relevant antitrust market in which Google Play store participates. Two products can participate in the same antitrust market and yet one product's price, profit margin, share, or other outcome measure may not be an appropriate benchmark for the other's. For example, a higher quality product may be in the same relevant antitrust market as a lower quality product; yet, the price of the lower quality product generally would not be a sound benchmark for the price of the higher quality product (or vice-versa) precisely because of the quality difference, which would, in general, create both supply-side and demand-side differences between the two products.

164. Dr. Rysman compares his but-for Google Play service fee rate of 15% to a largely overlapping but smaller set of claimed benchmarks than Dr. Singer. It is unclear if that reflects Dr. Rysman's disagreement with Dr. Singer or Dr. Rysman simply failing to consider the additional stores Dr. Singer claimed are benchmarks. Specifically, Dr. Rysman consideres only PC app stores and alternative Android App stores. He tries to justify the comparison with PC app stores by simply noting that "Google itself considers PC app stores as a 'competitive benchmark'." Dr. Rysman offeres no independent assessment and assumes that the phrase "competitive

benchmark" used in the internal presentation has exactly the same meaning as an economist assigns to that term.[224] In particular, the Google internal documents do not state that the rates charged by PC app stores represent rates that, without any adjustment, would have been appropriate for Google Play in the but-for world in this case. Rather, one could also interpret the documents to be making the simpler point that PC app stores are competitors to Google Play and then indicating what rates those stores charge. In that case, the PC app store rates could not be deemed appropriate benchmarks for the but-for world in this case without further analysis. With regard to the alternative Android app stores, Dr. Rysman does not even try to justify the comparison. Curiously, when making the comparison, Dr. Rysman emphasizes that the service fee rates on the PC app stores "are bounded above by Google's service fee of 30 percent and the lower service fees are in-line with the service fees that Google has offered to various price sensitive developers over time" and the service fee rates on alternative Android App stores "are generally below 30 percent, which provides yet another indication that mobile app stores are able and willing to decrease their commissions below 30%."[225] He does not claim that the fees charged by any of the alternative app stores support his uniform 15% but-for service fee rate. To the contrary, given that several stores in Dr. Rysman's list charge 30% for at least certain transactions, Google Play's 30% service fee rate is within the range that Dr. Rysman apparently finds "competitive."

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[224] Indeed, the internal presentations cited by Dr. Rysman [redacted] See Google, "Play Business Model Thoughts," GOOG-PLAY-000565541.R-562.R, at 558.R [redacted] Google, "Exploring new business models," March, 2019, GOOG-PLAY-000542516.R-535.R, at 529.R-530.R. [redacted]

[225] Rysman Report ¶ 478.

165. There are many reasons why these other platforms are not appropriate benchmarks for Google Play store in the but-for world.

166. None of the app stores Drs. Singer or Rysman identifies has a user installed base comparable to that of Google Play even in Dr. Singer's but-for world where Google Play retains a 60% share. Steam's gaming app library is 10% of the size of Google Play's gaming app library; the Epic Games Store, Microsoft Store, and Game Jolt Store are even smaller.[226] The Amazon Appstore is about 15% (in first quarter to 2021) to 26% (in 2017) of Google Play, and the Samsung Galaxy store is about 4%-6% (in 2017) of Google Play.[227] The economics literature demonstrates that installed base is an important determinant of fees charged by a two-sided platform.[228]

167. Google had and would still have had the first-mover advantage in the but-for world; none of the platforms Dr. Singer and Dr. Rysman considered would have replaced Google as the first mover. Dr. Singer agrees and Dr. Rysman does not claim otherwise.[229] Relatedly, Dr. Singer ignores the dynamic nature of service fee rate setting. For example, pricing by a new entrant can change over time as the entrant and the marketplace mature. Such changes may be due to consumers better understanding the value proposition over time and the emergence of other competitors, among others. Indeed, Microsoft charged a 30% service fee on game apps up until Aug 2021, most of the alleged damages period. Dr. Singer cites only the more recent service fee rates charged by these other stores and improperly ignores that these same "benchmarks" charged

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[226] Rysman Report ¶ 204; Rysman Report Appendix G.

[227] Rysman Report ¶¶ 150, 312.

[228] See Mark Armstrong, "Competition in Two-Sided Markets," *RAND J. ECON.*, 2006, pp. 668-691.

[229] Singer Class Rebuttal Report ¶ 40 ("In addition, as the distributor of the initial application and the owner of the Android operating system, Google would have an incumbency advantage, providing with a continued economic incentive to distribute as many applications as possible.")

higher service fee rates at earlier points in time. Dr. Singer provides no basis to rule out the earlier, higher rates as the better indications for what the but-for Google Play service fee rate would have been. Dr. Rysman, on the other hand, emphasizes the importance of competitive dynamics. He discusses how multiple app stores lowered service fees over time which he argued were their responses to competitive pressure. However, while Dr. Rysman also discusses how Microsoft Store initially set a commission rate of 30% and lowered it only in 2021, he chose not to show Microsoft Store's 30% commission rate prior to 2021 in his Exhibit 68.[230]

168. Furthermore, Dr. Singer argues that many stores, especially Android app distributors like Amazon and Aptoide, were disadvantaged by Google's anticompetitive conduct in the actual world and therefore, could not effectively compete. Because pricing is affected by the competitive landscape, it could very well have been that in response to the alleged disadvantages, Amazon and Aptoide lowered their service fee rates in the actual world below what they would have charged in the but-for world. In that case, the Amazon and Aptoide service fee rates in the actual world would be too low to serve as reliable benchmarks for the Google Play service fee rate in the but-for world.

169. Both Dr. Singer and Dr. Rysman ignore two-sided platforms that charge 30% or close to 30% service fee rates, with no explanation given. For an unbiased assessment, Dr. Singer and Dr. Rysman need to show why their low service rate platforms are more comparable to Google Play store than other platforms charging 30% or nearly 30% service fee rates. They do not do so. This is particularly puzzling given that Dr. Singer went far afield, claiming benchmarks in industries outside of app stores, including online retail and online publishing. For example, as I discuss

[230] Rysman Report Exhibit 68.

below, app stores in China often charge more than 30% while none has a market share anywhere close to 60%. Table 10 below shows some of the platforms charging rates more comparable to and sometimes even higher than Google Play's 30% service fee rate.

Table 10. Benchmarks Proposed by Drs. Singer and Rysman

Platform Type	Platform	Service Fee Rate	Notes
Game Console Store	Microsoft Store for Xbox	30%	15% for non-video game subscriptions. 15% for non-Xbox purchases (except certain Business, Education, and Games apps on Windows 8).
	Nintendo E-Shop	30%	
	PlayStation Store	30%	
PC Gaming Store	Steam	30%	25% for sales between $10 million and $50 million. 20% for sales greater than $50 million.
Mobile App Store	Samsung Galaxy Store	30%	
	Amazon Appstore	30%	20% for app developers with less than $1 million in app revenue, plus 10% of revenue as credit for AWS.
Book and Audiobook Publishing	Audible-ACX	60% or 75%	Commission rates are increased for audiobooks which are not exclusively distributed.
	Kindle Direct Publishing	30% or 65%	Kindle Direct publishers may choose between a "35% Royalty Option" and a "70% Royalty Option."

Source: See Exhibit 17.

170. Dr. Singer's and Dr. Rysman's claimed benchmarks are further flawed. Many stores that they argue are appropriate benchmarks charge a hybrid rate (i.e., different rates on different types of transactions). Neither Dr. Singer nor Dr. Rysman report the effective service fee rate for any of them. Therefore, they could not rule out the possibility that the effective rates are much closer to 30% than the but-for rates that Dr. Rysman uses for Google Play in the but-for world.

171. Lastly, except for the Epic Game Store, a highly specialized app store for games, which has a much smaller user base and charges a uniform 12% service fee rate, none of the stores Dr. Singer and Dr. Rysman claim to be comparable charges a uniform rate across the board. Yet, Dr. Rysman claims that Google Play store, which still would have had a significant share in Dr. Singer's but-for world, would have been the only other store that charges a uniform 15% service fee rate, a rate that would have been below almost every other store. This makes no economic sense.

X. CONSUMERS – DISGORGEMENT AND RESTITUTION CALCULATIONS

A. Overview of Mr. Solomon's Disgorgement and Restitution Calculations

172. Mr. Solomon calculates disgorgement as the difference between Google Play's actual and but-for incremental profits, where the actual incremental profits are calculated using Google's P&Ls,[231] and the but-for incremental profits are calculated using inputs from Dr. Singer's and Dr. Rysman's damages models and Google's P&Ls.[232]

173. Specifically, Mr. Solomon calculates the but-for revenue as the sum of [1] the but-for app revenue and [2] the but-for non-app revenue, and the but-for cost as the sum of [3] the but-for app cost and [4] the but-for non-app cost. That is, the but-for incremental profits are calculated as [1] + [2] - [3] - [4], with each term calculated as follows:

- [1] The but-for app revenue is calculated using inputs from Singer's and Rysman's damages models:

[231] See Solomon Report ¶¶ 75 - 83.

[232] See Solomon Report ¶¶ 84 - 130. Mr. Solomon allocated disgorgement and restitution damages to the US and the 39 States based on revenue shares of US and the 39 States relative to worldwide.

- **Singer's take rate models:** Mr. Solomon uses three parameters from Dr. Singer's app/in-app take rate model[233] and the single take rate model[234]: [a] the price effect, i.e., the percentage change in Google's revenue per transaction; [b] the quantity effect, i.e., the percentage change in the number of transactions in the market in response to the price changes of paid apps and IAPs from changes in the service fee rate passed through to app prices; and [c] Google Play's but-for market share, i.e., 60%. He then calculated the but-for app revenue as Google Play's actual net app revenue * (1 - [a]) * (1 + [b]) * 60%.

- **Singer's discount model:** Mr. Solomon similarly uses three parameters from Dr. Singer's discount model: [a] the price effect, i.e., the increase in the dollar amount of discounts Google provided to consumers as a percentage of actual net consumer app price; [b] the quantity effect, i.e., the percentage change in the number of transactions in the market in response to the price changes of paid apps and IAPs from changes in Google discounts; and [c] Google Play's but-for market share, i.e., 60%.[235] He then calculates the but-for app revenue as (Google Play's actual net app revenue – actual net consumer spend incurred in the Google Play store * [a]) * (1 + [b]) * 60%.

- **Singer's Amazon discount model:** Mr. Solomon also uses Dr. Singer's Amazon discount model to obtain [a] the price effect, i.e., the increase in the dollar amount of discounts Google provided to consumers as the difference between Amazon Appstore's 19.26% consumer subsidy and Play Store's actual 1.61% consumer subsidy. He calculates the but-for app revenue as (Google Play's actual net app revenue – actual net consumer spend incurred in the Google Play store * [a]).[236]

- **Dr. Rysman's pooled and IAP models:** Mr. Solomon simply applies the but-for service fee rate in Dr. Rysman's pooled model for a single market for in-app transactions and paid downloads (i.e., 15% for both types of transactions) and the IAP market model (i.e., 15% for IAPs and the actual service fee rate of 30% for paid downloads) to calculate the but-for app revenue as the actual net consumer spend of IAPs and paid downloads incurred in the Google Play store multiplied respectively by their assumed but-for service fee rates.

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[233] See Solomon Report ¶¶ 87 - 89.

[234] See Solomon Report ¶¶ 113 - 114.

[235] See Solomon Report ¶¶ 103 - 105.

[236] See Solomon Report ¶¶ 108 - 110.

- [2] The but-for non-app revenue is assumed to be same as the actual non-app revenue.[237]

- [3] The but-for app cost is calculated as the but-for app revenue multiplied by one minus the actual Google Play operating profit margin for apps.[238]

- [4] The but-for non-app cost is assumed to be the same as the actual non-app cost.[239]

174. Mr. Solomon also calculates two types of consumer restitution - the profit-based restitution and the revenue-based restitution.[240] He calculates the profit-based restitution as the difference between Google Play's actual and but-for incremental profits multiplied by the pass-through rate. The but-for incremental profits are calculated as the sum of the but-for app revenue and the but-for non-app revenue, minus the sum of the but-for app cost and the but-for non-app cost, where the but-for app revenue is calculated using inputs for the percentage change in Google's revenue per transaction, i.e., the price effects (without considering the percentage change in the number of transactions in the market in response to the price changes of paid apps and IAPs, i.e., the quantity effect) from Dr. Singer's app/in-app take rate model, the single take rate model, and the discount models (the discount model and the Amazon discount model), as well as the pass-through rate estimated by Dr. Singer. The price effect inputs are calculated in the same way as in the disgorgement calculations. The input for the pass-through rate is 91.1% in the take rate models and 100% in the discount models. Mr. Solomon calculates the revenue-based restitution as the

[237] See Solomon Report ¶ 90.

[238] See Solomon Report ¶ 95.

[239] See Solomon Report ¶ 91.

[240] See Solomon Report ¶ 19.

difference between Google Play's actual and but-for revenue multiplied by the same set of pass-through rate inputs.[241]

B. Critiques of Mr. Solomon's Calculations

175. Since Mr. Solomon's disgorgement and restitution calculations essentially rely on estimates from Drs. Singer and Ryman's damages models, his calculations suffer the same flaws as Drs. Singer and Ryman's damages models.[242]

176. There is one additional conceptual problem with Mr. Solomon's disgorgement calculation. The "ill-gotten profits" from a platform's exclusionary conduct in general derive from a number of sources, including the entities on different sides of the firm's platform (such as consumers and developers in the present case) and rival platforms (such as competing app stores in the present case). For example, the firm's conduct may have increased its profits by taking share from rivals and being able to charge higher prices to entities on the various sides of its platform. From an economics point of view, when a particular group, say, consumers, brings a litigation, that group should be entitled only to a *portion* of the "ill-gotten profits" that reflects the relative antitrust harm it sustained compared to other groups. Otherwise—if each group was entitled to claim the *entire* "ill-gotten profits" for itself—there would necessarily be multiple recovery of the same "ill-gotten profits." Thus, a disgorgement calculation should (from an economics viewpoint) apportion the total "ill-gotten profits" among the various claimants, with each claimant entitled only to its

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[241] The but-for app revenue here also only considers the effect of "reduction in (platform) pricing" and does not consider any quantity effect.

[242] In Sections XI. E and XI. F, I replace the inputs that Mr. Solomon takes from Drs. Singer and Rysman, including the price effect, quantity effect, and Google Play's actual and but-for market shares, with estimates based on empirical estimation or supported by empirical evidence, to calculate disgorgement and restitution. The calculations and approaches demonstrate that Mr. Solomon's disgorgement and restitution calculations are flawed. Further, as I discuss below, according to Dr. Skinner, Mr. Solomon does not properly account for Google Play's costs in his calculations. See Expert Report of Skinner ("Skinner Report").

apportioned amount.[243] Because Mr. Solomon has not performed the necessary apportionment to consumers, his disgorgement calculation is substantially overstated as a remedy for consumers.

XI. Corrected Consumer Damages, Restitution, and Disgorgement Calculations

A. Overcharge Damages Calculation

1. But-For Service Fee Rate

a. Recent Changes in the Service Fee Rate

177. Dr. Singer assumes, alternatively, that Google would have changed only its service fee rate in the but-for world and that it would have changed only its consumer subsidies in the but-for world. Indeed, given the platform nature of the Play Store, Google may not have chosen to adjust both the service fee and the consumer subsidies in the but-for world. In this section, I calculate consumer damages based on Google choosing only to change its service fee rate in the but-for world.

178. Instead of making unsupported assumptions that are divorced from economic reality, as Dr. Singer and Dr. Rysman have done, a much more reasonable but-for world is one based on what happened in the recent history in the actual world. As discussed above, Google has reduced the service fee rate multiple times, with the most recent two reductions occurring on July 1, 2021 and January 1, 2022. The July 1, 2021 change reduced the Google Play service fee rate to 15% for the first $1 million of a developer's global gross earnings from paid downloads and in-app purchases

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243 I note that Mr. Solomon's disgorgement calculation is much larger than his restitution calculation. The most important reason for this is that the disgorgement calculation has not been apportioned to consumers, while the restitution calculation has been implicitly apportioned to consumers (because it is focused on directly measuring the harm to consumers).

(including subscriptions) in each calendar year after they complete enrollment;[244] and the January 1, 2022 change reduced the Google Play service fee rate to a flat 15% for all subscription sales through the Google Play store.[245] As a more reasonable alternative to Dr. Singer's and Dr. Rysman's flawed approaches to determining the but-for service rate, I used Google's 2022 service fee rates as a benchmark. With Google Play serving as a benchmark for itself, economic similarity of the benchmark to the target is ensured. In 2022, as discussed above, Google has decreased its service fees in response to competitive pressure.[246] I assume that, in the but-for world, the current rate structure as implemented in 2022 would have been adopted from an earlier point in time. That is, the service fee rate for subscriptions would have been 15% for all subscription products; the service fee rate would have been 15% for the first $1 million of each developer's annual gross revenue and 30% for the portion of their gross revenue exceeding the first $1 million. The but-for service fee rate from this earlier time point to December 2021 would be the same as the actual average service fee rate under the current rate structure, i.e., [redacted] on average based on the period of January 2022 to May 2022.[247]

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[244] The service fee rate reverts to 30% once the $1 million annual cap (partial year cap of $500,000 for 2021) is reached. Developers must complete enrollment to receive the reduced 15% service fee rate. As noted by Google, the 15% service fee tier will go into effect on July 1, 2021 for all developers who have completed enrollment before this date; for developers who complete enrollment after July 1, 2021 the 15% will be applied starting from the date when enrollment is completed. "Changes to Google Play's service fee in 2021", Play Console Help, https://support.google.com/googleplay/android-developer/answer/10632485.

[245] "Evolving Our Business Model to Address Developer Needs," Android Developers Blog, October 21, 2021, https://android-developers.googleblog.com/2021/10/evolving-business-model.html.

[246] I note that competitive pressure may exist even if there are no actual competitors in the relevant market. See Dennis W. Carlton and Jeffrey M. Perloff, Modern Industrial Organization, 4th edition, 2005, p. 76. Note that Dr. Singer also argues that the *threat* of developer steering and multi-homing is sufficient to constraint market power and prices. Singer Class Rebuttal Report ¶ 62.

[247] Since the 15% reduced rate is applied to the first $1 million of each developer's annual global gross revenue based on their "Associated Developer Account", and that the Google Play transactions data only includes transactions associated with U.S. consumers and does not provide the "Associated Developer Account" ID, apply the average service fee rate based on the actual transactional level service fee rates in 2022 to all the

b. China as a Comprehensive Benchmark for the But-For World

179. Google Play is not present in China, and there are many app stores for Android devices. While there are other differences between China and the U.S., China nevertheless provides useful information regarding the but-for world in this case. Based on the evidence summarized below, circumstances in China demonstrate that the service fee rate can be even higher than 30% even if many app stores compete in the market. The costs to consumers (and developers) may be higher, as well.

180. There are currently more than 400 Android apps stores in China, with the top 10 stores accounting for about 90% of the market.[248] The major app stores are either OEM app stores, such as Huawei AppGallery (Huawei), VIVO App Store (Vivo), and OPPO Software Store (OPPO), or third-party app stores operated by internet companies, such as Tencent My App (Tencent), 360 Mobile Assistant (Qihoo 360), and Baidu Mobile Assistant (Baidu).[249]

181. Despite the fact that there are many app stores which compete intensely with each other, the service fee rates are relatively high, with the prevailing service fee rate for games at around 50%. Even when some of the largest app developers, such as Tencent, have managed to negotiate lower fees with some stores, the negotiated rate is still as high as 30%.[250] In addition to the service fee fees, app stores typically also charge a 2%-25% "channel fee" that is akin to a payment processing fee. For example, Huawei AppGallery charges a 2% channel fee, a 50% service fee

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transactions from the earlier time point to December 2021, rather than directly applying the first $1 million of each developer's annual gross revenue and 15% for all transactions involving subscriptions.

[248] "All You Need to Know About China's Top Android App Stores," Nativex, September 6, 2021, https://www.nativex.com/en/blog/all-you-need-to-know-about-china-top-android-app-stores/.

[249] "The AppInChina App Store Index", AppInChina, May 2022, https://www.appinchina.co/market/app-stores/.

[250] "Tencent Urges App Stores to Change Revenue Sharing Model," Sohu, July 16, 2019, https://www.sohu.com/a/327058178_161105.

rate for game in-app purchases, and a 30% for paid downloads and non-game in-app purchases.[251] The total effective service fee rate for game in-app purchases is then 2% + (1 - 2%) * 50% = 51%, and the total effective service fee rate for paid downloads and non-game in-app purchases is then 2% + (1 - 2%) * 30%=31.4%. See Exhibit 20 for the major Android app stores' service fee rates in China. The but-for service fee rate I used for my alternative damages calculations is lower than most of these rates.

182. Developers face development and maintenance costs due to the fragmented market structure and cross-fire between OEM and third-party app stores. Different store requirements (for app listing, review timeframe, payment, and etc.) lead to a high app incompatibility rate in China (32.7%), nearly triple the rate in the rest of the world (11.7%).[252] App stores scrape each other for apps and updates without getting developer approval.[253] Developers respond by self-hosting APKs on their websites, outsourcing app publishing to third-party publishing tools and services for a fee,[254] and implementing fixes to get control over the versions on different app stores.[255]

183. From the perspective of consumers in China, the large number of Android app stores creates challenges for app stores to screen malicious apps and leads to large variance in app stores' app review standards. As a result, consumers in China face high risk of virus, malicious ads, junk

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[251] See Exhibit 20.

[252] GOOG-APPL-00044136; "A Fragmented Market – Androids in China," Medium, April 27, 2017, https://medium.com/@david9289david/a-fragmented-market-androids-in-china-92a8c3ea71b1.

[253] GOOG-PLAY-000272539 at 578; "Why Do I Need a Security Solution for My App?," AppInChina, October 10, 2019, https://www.appinchina.co/blog/why-do-i-need-a-security-solution-for-my-app/.

[254] Third-party publishing tools and services, e.g., KuChuan, provide services to customize apps to meet different store requirements and monitoring app scraping by stores after publishing. See "KuChuan: How to Solve the Problem of Multi-Channel Publishing and Monitoring for App Developers," woshiipm, http://www.woshipm.com/it/55456.html.

[255] GOOG-APPL-00044136.

apps, and pirated apps when downloading apps from Android mobile app stores.[256] Hence, the existence of many app stores does not effectively expand consumers' choice sets, but rather have resulted in a large number of low quality or malicious apps and user privacy and security issues.[257]

2. Pass-Through Rate

184. I conservatively use the econometric estimate of the pass-through rate discussed above. As shown in Table 8, I find that the weighted average pass-through rate (based on the upper bound of the 95th confidence intervals) across transactions of paid downloads, IAPs, and subscriptions is 3.0%.

3. Calculation

185. I calculate the consumer class overcharge damages as the difference between the actual and but-for service fee rates multiplied by the pass-through rate, and then multiplied by the actual total consumer spend. The consumer class damages from changes in the service fee rate are zero for the period of January 2022 to May 2022, as the actual and but-for service fee rates are the same in this period.[258] As shown in Table 11 below, the consumer class damages would be [redacted] if Google's current rate structure as implemented in 2022 would have been adopted from the beginning of the class period (August 16, 2016). I also provide consumer class damages for an alternative period starting September 1, 2018, the date of the initial launch of the Google Play

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[256] Haoyu Wang et al., "Beyond Google Play: A Large-Scale Comparative Study of Chinese Android App Markets," Proceedings of the Internet Measurement Conference 2018, 2018, https://dl.acm.org/doi/abs/10.1145/3278532.3278558, at p. 9.

[257] Yi Ying Ng *et al.*, "Which Android App Store Can Be Trusted in China?," *IEEE 38th Annual Computer Software and Applications Conference*, 2014, p. 8.

[258] The consumer class damages can be apportioned to a state-by-sate level using state-level consumer spend or Google revenue as weights.

Points program worldwide in Japan, which amount to [redacted]. I understand that some of the allegedly anticompetitive conduct at issue, such as RSA 3.0, did not occur until 2019.

Table 11. Consumer Class Damages From Changes in the Service Fee Rate

	August 16, 2016 - May 31, 2022	September 1, 2018 - May 31, 2022
Consumer Damages from Overcharge	[redacted]	

Source: See Exhibit 18.

B. Consumer Subsidy Damages Calculation

186. In this section, I provide an estimate of the but-for consumer subsidies that Google would have offered based on the same considerations as my estimate of the but-for service fee. This damages calculation corresponds to Dr. Singer's and Dr. Rysman's consumer subsidy-based damages calculations.

187. Google launched the Play Points program in the U.S. in November 2019.[259] After consumers join the program with a valid payment method on Google Play, Play Points are awarded for every purchase (including paid downloads, IAPs, subscriptions, movies, and books), as well as from other actions such as program enrollment and item downloads.[260] There are four Play Points tiers offered in the U.S.: Bronze, Silver, Gold, and Platinum - the more points a consumer earns, the higher their level gets, and the more Points awards (such as weekly prizes) they will receive.[261]

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[259] "Google Play Help, Introducing Google Play Points in the U.S.," Android Developers Blog, November 4, 2019 https://android-developers.googleblog.com/2019/11/introducing-google-play-points-in-us.html.

[260] Feng Deposition, page 444: 25-445: 18, 447: 4-12, 497: 23-498: 7.

[261] "How to check your Google Play Points level & benefits", Google Play Help, https://support.google.com/googleplay/answer/9080348?hl=en&co=GENIE.CountryCode%3DUS. "Google Play Points: a rewards program for all the ways you Play", The Keyword, Nov. 4, 2019,

Specifically, consumers get one Play Point per dollar spent in the store on apps, in-app purchases, or media purchases and rentals for base tier ("Bronze"), and the reward rate increases to 1.1, 1.2, and 1.4 Points per dollar spent for "Silver", "Gold", and "Platinum" level users.[262] Google also offers special rates and promotions when consumers can get more points for every dollar spent.[263] Google funds all the Points that consumers earn and there is no cost to developers as consumers earn points.[264] Points expire one year after the last time a consumer earns or uses points.[265] During the period of November 2019 (when Points were launched in the U.S.) and May 2022 (till when the transactions data is available), assuming that 100 Points are worth $1 dollar, the dollar amount of Points subsidies offered by Google to consumers accounts for [redacted] of total consumer spend.

188. Google also offers other types of discounts to consumers, mainly through co-funding promotions with developers and directly offering promotions to consumers that reduce the net prices that consumers pay. From the beginning of the Class Period (August 16, 2016) to May 31, 2022, the non-Play Points discounts offered by Google to consumers account for [redacted] of total consumer spend. During the period of November 2019 and May 2022, the non-Play Points discounts offered by Google to consumers account for [redacted] of total consumer spend.

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https://www.blog.google/products/google-play/google-play-points-rewards-program-all-ways-you-play/. Also see "Google Launches a Rewards Program for Android Users", MUO, Nov. 5, 2019, https://www.makeuseof.com/tag/google-rewards-program-android-users/.

[262] See "What Are Google Play Points and How Can You Use Them?", MUO, Apr. 8, 2021, www.makeuseof.com/what-are-google-play-points/.

[263] "How to check your Google Play Points level & benefits", Google Play Help, https://support.google.com/googleplay/answer/9080348?hl=en&co=GENIE.CountryCode%3DUS.

[264] GOOG-PLAY-00518034. Google and developers jointly fund the Play points if users change points for discounted IAP items and coupons (developers offer discount and Google fund the Play Points users redeemed). See Feng Dep., page 449: 6-12, 450: 21-452: 13.

[265] "Earn and track your Google Play Points," Google Play Help, https://support.google.com/googleplay/answer/9077192?hl=en&co=GENIE.CountryCode%3DUS#:~:text=Any%20points%20you%20earn%20will,progress%20when%20you%20use%20them..

189. In the but-for world, I assume that the Play Points program would have begun at an earlier point in time in the U.S. in response to greater app store competition. The but-for percentage of the Play Points subsidies from this earlier time point to November 2019 would be the same as the actual percentage of the Play Points subsidies when the program is actually running in the U.S., i.e., [redacted] on average based on the period of November 2019 to May 2022.

190. Play Points do expire.[266] A Google internal document reported that as of December 31, 2021, approximately [redacted] have been redeemed and approximately [redacted] of points issued more than 12 months ago have expired.[267] Consequently, I adjust the Play Points-based damages downward by [redacted]. Even after this adjustment, my calculation is conservative for at least two reasons. First, some non-expired points may never get redeemed, implying that the [redacted] is a lower bound. Second, some Play Points redemptions may take place well after their issuance, so the present discounted value of a Play Point is less than its face value. Intuitively, today's value of savings resulting from, say, 100 Play Points today is different from than if the same 100 Play Points were redeemed a year later, due to time value of money.[268]

191. I similarly assume that the higher non-Points discounts that Google provides to consumers after the Play Points program was launched in the U.S. would have been applied starting at an earlier point in time in the U.S. in response to greater app store competition. I assume that the but-for non-Points Google discounts from this earlier time point on until November 2019 would have

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[266] Earn and track your Google Play Points, Google Play Help, https://support.google.com/googleplay/answer/9077192?hl=en&co=GENIE.CountryCode%3DUS#:~:text=Any%20points%20you%20earn%20will,progress%20towards%20the%20next%20level. ("Any points you earn will expire one year after the last time you earned or used points.")

[267] GOOG-PLAY-011271382 at 401.

[268] See "Chapter 3. Time Value of Money" in Smart, Scott B., William L. Megginson, and Lawrence J. Gitman, Corporate Finance, 2nd Edition, Thomson, 2007.

been the same as the actual percentage of non-Points Google discounts during period of November 2019 to May 2022 when the Play Points program is active in the U.S. This discount amounts to be [redacted] on average.

192. For the two types of consumer subsidies, I calculate the consumer class damages respectively as the difference in the actual and but-for subsidy rates multiplied by the actual total consumer spend from the time point when the but-for subsidy rate would have been applied until November 2019. The consumer class damages from either type of consumer subsidies are zero for the period of November 2019 to May 2022, as the actual and but-for subsidy rates are the same in this period.[269], [270]

Table 12. Consumer Class Damages
From Changes in Consumer Subsidies Offered by Google

	August 16, 2016 - May 31, 2022	September 1, 2018 - May 31, 2022
Consumer Damages from Play Points	[redacted]	
Consumer Damages from Non-Points Google Discounts		
Combined		

[269] Note that my calculations do not project any future damages. I reserve the right to update the calculations for future damages when updated data becomes available.

[270] For the consumer class, I estimate aggregate damages. Empirically, less than one-third of U.S. consumers participated in the Play Points program and only up to [redacted] of U.S. consumers earned and redeemed Play Points. Therefore, it is highly unlikely that all or nearly all class members would have enrolled in the program in the but-for world and suffered damages as a result of the but-for Play Points. Dr. Singer has claimed otherwise, arguing that this empirical real-world observation "does not prove that a more generous program would not see more widespread redemptions. Consumers would have enhanced economic incentives to enroll and participate in a Play Points offering more valuable incentives in the but-for world, just as consumers have more incentives to participate in a more generous credit card rewards program than a less generous one." Singer Report ¶ 381. Dr. Singer then speculates that in the but-for world, "consumers could be automatically enrolled in Play Points. Discounts could be automatically redeemed at the point of purchase or even dispensed through a 'cash-back' program." Singer Report ¶ 381. However, Dr. Singer fails to provide a sound basis for his speculation, particularly for his implicit claim that all or nearly all consumers would enroll in the program, earn points, and redeem them in the but-for world.

Source: See Exhibit 19.

C. Variety Damages Calculation

193. As discussed above, the variety damages calculation is entirely speculative because, for example, there is no indication as to which apps (if any) did not enter in the actual world, but would have entered in the but-for world. Without knowing which apps would have entered, the consumer loss associated with not having those apps is not ascertainable. Accordingly, variety damages, if any, cannot be reliably measured.

D. Restitution

194. I present the corrected restitution calculations in Tables 13 and 14. I separately calculate the restitution from changes in Google's service fee rate and consumer subsidies in the but-for world, where the percentage change in Google's per-unit revenue (i.e., the price effect) are calculated in the same way as for disgorgement. I calculate the allocated restitution amounts for each of the 39 States by using Google revenue at the state-level as weights, as shown in Exhibits 21-22.

Table 13. Restitution from Changes in Service Fee Rate (in Millions USD)
2016.08.16 - 2021.12.31

Description	Calculation	Profits-Based Restitution	Revenue-Based Restitution	Source
Actual Google Play Apps & Games Reve	[A]	$45,481	$45,481	Solomon Report, Schedule 5
Actual Service Fee Rate	*[1]*	29%	29%	Google Play Transactions Data
But-for Service Fee Rate	*[2]*	26%	26%	Estimated, See Section XI.A
Actual Play Points %	*[3]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Play Points %	*[4]*	[redacted]	[redacted]	Same as Actual
Actual Google Discount %	*[5]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Google Discount %	*[6]*	[redacted]	[redacted]	Same as Actual
Pass-through Rate	*[7]*	3.0%	3.0%	Empirical Estimate, See Exhibit 5
Percentage Reduction in Per-Unit Apps & Games Revenue	[B]	[redacted]	[redacted]	Calculated based on [1] - [7]
But-For Google Play App & Game Reve	[C] = [A]*(1-[B])	[redacted]	[redacted]	Calculated
Actual Google Play Other Revenue	[D]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Google Play Revenue	[E] = [C]+[D]	[redacted]	[redacted]	Calculated
Actual Google Play Operating Profit Margin for App & Games	[F]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Google Play App & Games Cost	[G] = [C]*(1-[F])	[redacted]	[redacted]	Calculated
Actual Google Play Other Costs	[H]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-for Total Google Play Costs	[I] = [G]+[H]	[redacted]	[redacted]	Calculated
But-For Incremental Profits	[J] = [E]-[I]	[redacted]	[redacted]	Calculated
Actual Incremental Profits	[K]	[redacted]	[redacted]	Solomon Report, Schedule 2
Excess Profits	[L.1] = [K]-[J]	[redacted]	[redacted]	Calculated
Consumer Savings	[L.2] = [A]-[E]	[redacted]	[redacted]	Calculated
Pass-through Rate	[M]	[redacted]	[redacted]	Empirical Estimate, See Exhibit 5
Consumer Restitution (Worldwide)	[L]*[M]	[redacted]	[redacted]	**Calculated**
Geographic Area		[redacted]	[redacted]	
US	Allocated	[redacted]	[redacted]	
39 States	Allocated	[redacted]	[redacted]	

Source: Exhibit 21.

Table 14. Restitution from Changes in Consumer Subsidies (in Millions USD) 2016.08.16- 2021.12.31

Description	Calculation	Profits-Based Restitution	Revenue-Based Restitution	Source
Actual Google Play Store Consumer Sper	[A]	$158,540	$158,540	Solomon Report, Schedule 4
Actual Service Fee Rate	*[1]*	29%	29%	Google Play Transactions Data
But-for Service Fee Rate	*[2]*	29%	29%	Same as Actual
Actual Play Points %	*[3]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Play Points %	*[4]*	[redacted]	[redacted]	Estimated, See Section XI.B
Actual Google Discount %	*[5]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Google Discount %	*[6]*	[redacted]	[redacted]	Estimated, See Section XI.B
Actual Developer Discount	*[7]*	[redacted]	[redacted]	Google Play Transactions Data
Percentage Reduction in Per-Unit Consumer Spend	[B]	[redacted]	[redacted]	Calculated based on [1] - [7]
Reduction in App & Games Revenue	[A]*[B]	[redacted]	[redacted]	Calculated
Actual Google Play Apps & Games Reve	[C]	[redacted]	[redacted]	Solomon Report, Schedule 5
Actual Google Play Other Revenue	[D]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Google Play Revenue	[E] = [C]-[A]*[B]+[D]	[redacted]	[redacted]	Calculated
Actual Google Play Operating Profit Margin for App & Games	[F]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Google Play App & Games Cost:	[G]=([C]-[A]*[B])*(1-[F])	[redacted]	[redacted]	Calculated
Actual Google Play Other Costs	[H]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-for Total Google Play Costs	[I] = [G]+[H]	[redacted]	[redacted]	Calculated
But-For Incremental Profits	[J] = [E]-[I]	[redacted]	[redacted]	Calculated
Actual Incremental Profits	[K]	[redacted]	[redacted]	Solomon Report, Schedule 2
Excess Profits	[L.1] = [K]-[J]	[redacted]	[redacted]	Calculated
Consumer Savings	[L.2] = [C]-[E]	[redacted]	[redacted]	Calculated
Pass-through Rate	[M]	[redacted]	[redacted]	
Consumer Restitution (Worldwide)	[L]*[M]	[redacted]	[redacted]	**Calculated**
Geographic Area		[redacted]	[redacted]	
US	Allocated	[redacted]	[redacted]	
39 States	Allocated	[redacted]	[redacted]	

Source: Exhibit 22.

E. Disgorgement

195. From an economics standpoint, a group should be entitled only to a portion of the "ill-gotten profits" that reflects the relative antitrust harm it sustained compared to other groups. Otherwise, there would necessarily be multiple recovery of the same "ill-gotten profits." The economically correct disgorgement calculation should therefore perform the necessary apportionment to consumers.

196. Nevertheless, for the sake of completeness, under the alternative but-for service fee rates and consumer subsidies, as well as the pass-through rate empirically estimated based on app

developers' real-world responses to service fee rate change, I present the corrected un-apportioned disgorgement calculations in Tables 15 and 16.

197. First, I calculate disgorgement from changes in Google's service fee rate. As shown in Table 13, I calculate the percentage change in Google's per-unit revenue (i.e., the price effect), the percentage change in the number of transactions in response to price change from service fee rate reduction pass-through (i.e., the quantity effect), and Google Play's actual and but-for market shares as follows.[271] I calculate the allocated disgorgement amounts for each of the 39 States by using Google revenue at the state-level as weights, as shown in Exhibit 23.

- The percentage change in Google's per-unit revenue is calculated based on Google Play's actual per-unit revenue and but-for per unit revenue, where the actual per-unit revenue is obtained from Solomon Report Schedule 5, and the but-for per-unit revenue is calculated by accounting for changes in the service fee rate between the actual and but-for worlds.[272] As discussed in Section XI. A above, I assume the but-for service fee rate to be 26.0%. I use a pass-through rate of 3.0% following my empirical estimation as discussed above.
- The percentage change in the sales quantity in response to price change from service fee rate reduction pass-through is calculated as the percentage change in app price from the actual to the but-for world multiplied by the demand elasticity. The percentage change in app price is calculated to account for the pass-through of

[271] Mr Solomon calculates disgorgement under two cost measures—(1) "adjusted costs" of Google Play, where he excludes "certain corporate-level expenses that Google has attributed to Play Store and that Google would have incurred even if the Play Store did not exist," and (2) the "fully burdened" costs of Google Play, where he "simply accepted as true Google's own representations about the fully burdened costs of Google Play." Mr. Solomon's own definition of disgorgement requires a measure of total costs "[a]ttributable [s]pecifically to and [a]ffected by Google Play's [r]evenue [g]eneration." Taking Mr. Solomon's definition of disgorgement as given, I understand from Dr. Skinner that even Mr. Solomon's "fully burdened" cost measure fails to account for all the costs attributable to and affected by the generation of Google Play revenue. Therefore, Mr. Solomon's "adjusted costs" would understate the true costs even further. Consequently, I use Mr. Solomon's fully burdened costs in my disgorgement calculations. See Solomon Report ¶¶ 10-11 and 14-15; Skinner Report.

[272] Let the pass-through rate be the change in app price divided by the change in service fee amount, i.e., $\gamma = \frac{P_2 - P_1}{t_2 P_2 - t_1 P_1}$, where t is service fee rate, P is app price, and the actual world parameters are labeled with subscript 1 and the but-for world parameters are labeled with subscript 2. The but-for to actual app price ratio can be derived as $\theta = \frac{P_2}{P_1} = \frac{1-\gamma t_1}{1-\gamma t_2}$. The percentage reduction in Google Play revenue from reduction in service fee is $1 - \frac{t_2 P_2 - d_1 P_2 - l_1 P_2}{t_1 P_1 - d_1 P_1 - l_1 P_1} = 1 - \theta \frac{t_2 - d_1 - l_1}{t_1 - d_1 - l_1}$, where d_1 and l_1 are Google offered non-Points discount rate and Play Points rate (same in the actual and but-for worlds).

the service fee reduction from 29% to 26%.[273] I conservatively use the demand elasticity that Dr. Singer uses to obtain the quantity effect, which has a magnitude of 1.46.[274]

- As discussed in Section VI.B.2, Dr. Singer's inputs for Google Play's actual and but-for market shares are flawed and unsupported. For the purposes of my calculation, I take as given Dr. Singer's claim that "the Play Store accounted for 85.9 percent of non-Apple mobile app expenditures outside of China in 2018" and use the more appropriate expenditure share of 85.9% as Google Play's actual market share"[275] For Google Play's but-for market share, I consider two scenarios by respectively assuming that (1) the but-for market share would be 73%, which is 15% reduction from the actual share of 85.9%, based on that ONE Store gained up to 15% of the Android app store revenue share in South Korea;[276] and (2) the but-for market share is the same as the actual market share of 85.9%.[277]

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273 As shown above, the but-for to actual app price ratio is $\theta = \frac{P_2}{P_1} = \frac{1-\gamma t_1}{1-\gamma t_2}$. Since consumer subsidy rates are the same in the actual and but-for worlds, the but-for to actual app price ratios for list price and net consumer price are the same. Hence, the percentage change in app price from the actual to the but-for world is $\theta - 1$. The increase in sales quantity is $(-1.46) \times (\theta - 1) = 1.46(1 - \theta)$.

274 Singer Report, Table 8.

275 Singer Report ¶ 122.

276 "Korean app market One Store to venture into SE Asia," The Korea Economic Daily, May 10, 2022, https://www.kedglobal.com/e-commerce/newsView/ked202205100005.

277 I reserve the right to update my calculations if more information or evidence becomes available. My calculation approach would apply to alternative assumptions regarding Google Play's but-for market share.

Table 15. Disgorgement from Changes in Service Fee Rate (in Millions USD) 2016.08.16 - 2021.12.31

Description	Calculation	Calculation 1 (ONE Store-Based But-for Market Share)	Calculation 2 (But-for Market Share Same as Actual)	Source
Actual Google Play Apps & Games Reve	[A]	[redacted]		Solomon Report, Schedule 5
Actual Service Fee Rate	*[1]*			Google Play Transactions Data
But-for Service Fee Rate	*[2]*			Estimated, See Section XI. A
Actual Play Points %	*[3]*			Google Play Transactions Data
But-for Play Points %	*[4]*			Same as Actual
Actual Google Discount %	*[5]*			Google Play Transactions Data
But-for Google Discount %	*[6]*			Same as Actual
Pass-through Rate	*[7]*			Empirical Estimate, See Exhibit 5
Percentage Reduction in Per-Unit Apps & Games Revenue	[B]			Calculated based on [1] - [7]
Subtotal	[C] = [A]*(1-[B])			Calculated
Demand Elasticity	*[8]*			Singer Merits Report, Table 8
Increase in Market Sales Quantity	[D]			Calculated based on [1] - [2], [8]
But-For Market App & Game Revenue	[E] = [C]*(1+[D])			Calculated
Actual Market Share	[F]			Singer Merits Report, ¶122
But-For Market Share	[G]			Empirical Evidence/Assumption
But-For Google Play App & Game Reven	[H] = [E]/[F]*[G]			Calculated
Actual Google Play Other Revenue	[I]			Solomon Report, Schedule 5
But-for Google Play Total Revenue	[J] = [H]+[I]			Calculated
Actual Google Play Operating Profit Margin for App & Games	[K]			Solomon Report, Schedule 5
But-For Google Play App & Games Costs	[L] = [H]*(1-[K])			Calculated
Actual Google Play Other Costs	[M]			Solomon Report, Schedule 5
But-for Total Google Play Costs	[N] = [L]+[M]			Calculated
But-For Incremental Profits	[O] = [J]-[N]			Calculated
Actual Incremental Profits	[P]			Solomon Report, Schedule 2
Disgorgement (Worldwide)	[P] - [O]			**Calculated**
Geographic Area				
US	Allocated			
39 States	Allocated			

Source: Exhibit 23.

198. Next I calculate disgorgement from changes in Google's consumer subsidies. See Table 16. The percentage change in Google's per-unit revenue (i.e., the price effect), the percentage change in the number of transactions in response to price change from service fee rate reduction pass-through and consumer subsidy increase (i.e., the quantity effect), and Google Play's actual and but-for market shares are calculated as follows. I calculate the allocated disgorgement amounts for each of the 39 States by using Google revenue at the state-level as weights, as shown in Exhibit 24.

- The percentage change in Google's per-unit revenue is calculated based on Google Play's actual per-unit revenue and but-for per unit revenue, where the actual per-unit revenue is obtained from Solomon Report Schedule 5, and the but-for per-unit revenue is calculated by accounting for changes in the Play Points subsidies and non-Points Google discounts between the actual and but-for worlds.[278] As discussed in Section XI. B above, I assume the but-for Play Points subsidy rate to be [redacted] and the but-for non-Points discount rate to be [redacted]

- The percentage change in the number of transactions in response to price change from consumer subsidy increase is calculated as the percentage change in the actual and but-for app prices multiplied by the demand elasticity. The actual app price is calculated based Solomon Report Schedule 5, and the but-for app price is calculated to account for the increase in the two types of consumer subsidies.[279] I conservatively use the demand elasticity that Dr. Singer uses to obtain the quantity effect, which is 1.46.[280]

- I use the same sets of actual and but-for Google Play market shares as in Table 15.

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[278] Google Play's revenue from game and app in the actual world is $(t_1P_1 - d_1P_1 - l_1P_1)$ and in the but-for world is $(t_1P_1 - d_2P_1 - l_2P_1)$, where t is service fee rate (same in the actual and but-for worlds), P is app price before Google offered consumer subsidy (same in the actual and but-for worlds), d and l are Google offered non-Points discount rate and Play Points rate, and the actual world parameters are labeled with subscript 1 and the but-for world parameters are labeled with subscript 2. The reduction in Google Play revenue from increase in consumer subsidy can be derived as $(d_2 + l_2 - d_1 - l_1)P_1$.

[279] The change in consumer net app price is $\frac{(1-d_2-l_2-\alpha)P_1-(1-d_1-l_1-\alpha)P_1}{(1-d_1-l_1-\alpha)P_1}$, where P is app price before Google offered consumer subsidy (same in the actual and but-for worlds), α is developer discount (same in the actual and but-for worlds), d and l are Google offered non-Points discount rate and Play Points rate, and the actual world parameters are labeled with subscript 1 and the but-for world parameters are labeled with subscript 2. The increase in sales quantity is $(-1.46) \times \left(\frac{(1-d_2-l_2-\alpha)}{(1-d_1-l_1-\alpha)} - 1\right) = 1.46\left(1 - \frac{(1-d_2-l_2-\alpha)}{(1-d_1-l_1-\alpha)}\right)$.

[280] Singer Report Table 8.

Table 16. Disgorgement from Changes in Consumer Subsidies (in Millions USD) 2016.08.16 - 2021.12.31

Description	Calculation	Calculation 1 (ONE Store-Based But-for Market Share)	Calculation 2 (But-for Market Share Same as Actual)	Source
Actual Google Play Store Consumer Spen	[A]	**$158,540**	**$158,540**	Solomon Report, Schedule 4
Actual Service Fee Rate	*[1]*	*29%*	*29%*	Google Play Transactions Data
But-for Service Fee Rate	*[2]*	*29%*	*29%*	Same as Actual
Actual Play Points %	*[3]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Play Points %	*[4]*	[redacted]	[redacted]	Estimated, See Section XI. B
Actual Google Discount %	*[5]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Google Discount %	*[6]*	[redacted]	[redacted]	Estimated, See Section XI. B
Actual Developer Discount	*[7]*	*0.35%*	*0.35%*	Google Play Transactions Data
Percentage Reduction in Per-Unit Consumer Spend	[B]	[redacted]	[redacted]	Calculated based on [3] - [7]
Reduction in App & Games Revenue	[A]*[B]	[redacted]	[redacted]	Calculated
Demand Elasticity	*[8]*	*1.46*	*1.46*	Singer Merits Report, Table 8
Increase in Market Sales Quantity	[C]	0.8%	0.8%	Calculated based on [3] - [8]
Actual Google Play Apps & Games Reve	[D]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Market App & Game Revenue	[E] = ([D]-	[redacted]	[redacted]	Calculated
Actual Market Share	[F]	[redacted]	[redacted]	Singer Merits Report, ¶122
But-For Market Share	[G]	[redacted]	[redacted]	Empirical Evidence/Assumption
But-For Google Play App & Game Reven	[H] = [E]/[F]*[G]	[redacted]	[redacted]	Calculated
Actual Google Play Other Revenue	[I]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-for Google Play Total Revenue	[J] = [H]+[I]	[redacted]	[redacted]	Calculated
Actual Google Play Operating Profit Margin for App & Games	[K]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Google Play App & Games Costs	[L] = [H]*(1-[K])	[redacted]	[redacted]	Calculated
Actual Google Play Other Costs	[M]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-for Total Google Play Costs	[N] = [L]+[M]	[redacted]	[redacted]	Calculated
But-For Incremental Profits	[O] = [J]-[N]	[redacted]	[redacted]	Calculated
Actual Incremental Profits	[P]	[redacted]	[redacted]	Solomon Report, Schedule 2
Disgorgement (Worldwide)	[P] - [O]	[redacted]	[redacted]	**Calculated**
Geographic Area		[redacted]	[redacted]	
US	Allocated	[redacted]	[redacted]	
39 States	Allocated	[redacted]	[redacted]	

Source: Exhibit 24.

XII. MATCH PLAINTIFFS' DAMAGES

A. Overview of Dr. Schwartz's Match Plaintiffs' Damages Calculation

199. Match Plaintiffs' damages expert, Dr. Schwartz, "calculate[s] damages as the difference between the actual service fees Tinder and OkCupid paid for use of GPB and what those service fees would have been in the but-for world."[281] Tinder's and OkCupid's actual service fees,

[281] Schwartz Report, ¶ 476.

referred to by Dr. Schwartz as "GPB Service Fees," are based on the Match Plaintiffs' actual financial data that provides "reports of global revenues, service fees, and downloads by app (i.e., Match, OkCupid, OurTime, PlentyofFish, and Tinder)."[282] According to Dr. Schwartz, "in the competitive but-for world, Google would implement two distinct fees reflecting the separate services provided by [Play] and [Google Play's billing system]: a. A charge for [Play] services, *i.e.*, Discovery Value and Delivery Value. b. A charge for IAP processing services, *i.e.*, FOP Value;"[283] and, more specifically, "in the but-for world, Tinder and OkCupid would still have compensated Google for the Discovery Value and Delivery Value and would have paid a competitive rate for IAP processing services."[284] Therefore, according to Dr. Schwartz's damages model, Tinder's and OkCupid's but-for service fees, referred to by Dr. Schwartz as "But-for Service Fees," are equal to the sum of the But-for Discovery Value and But-for Delivery Value (i.e., the fees that Tinder and OkCupid would have paid for Play in Dr. Schwartz's but-for world) plus the "Competitive IAP Processing Fees" (i.e., the fees that Tinder and OkCupid would have paid for Google Play's billing system in Dr. Schwartz's but-for world).[285] Dr. Schwartz's damages are equal to Tinder's and OkCupid's "GPB Service Fees" minus their "But-for Service Fees."

200. For the but-for value of Google Play's billing system, Dr. Schwartz "consider[s] a range of possible but-for rates for payment processing that are informed by the rates available from other providers, the rates the Match Plaintiffs' apps have historically paid to third-party processors when using their in-house systems, and Google's implied pricing for payment processing."[286] In his damages calculation Dr. Schwartz uses two sets of but-for payment processing rates: (1) 2.6% and

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282 Schwartz Report, ¶ 472. See also Schwartz Report, Attachments X-1 to X-5.
283 Schwartz Report, ¶ 469.
284 Schwartz Report, ¶ 476.
285 Schwartz Report, ¶ 476.
286 Schwartz Report, ¶ 425.

3.3% for Tinder and OkCupid, respectively, which represent the effective rates over the damages period to operate their in-house payment processing systems and are used in Dr. Schwartz's Base Case damages scenario; and (2) 4.8%, which represents the most common effective rate over the damages period using the rate structure of third-party payment processing providers and is used in Dr. Schwartz's High Rate damages scenario.[287]

201. To quantify the but-for value of Play (i.e., Discovery Value and Delivery Value), "separate and distinct from any value provided by [Google Play's billing system],"[288] Dr. Schwarz relies on Google's Tinder Play Value Estimate and Play Value Model that he claims show that the value of Play to Tinder and OkCupid was low.[289] According to Dr. Schwartz, "[t]he Play Value Model would have served as a reasonable starting point for negotiations between Match Plaintiffs and Google in the but-for world—a world in which Google was not able to tie [Play] to [Google Play's billing system]—to determine a service fee for the value provided by [Play]."[290]

202. Ultimately, under Dr. Schwartz's Base Case and for the damages period from 7/7/2017-12/31/2021, Dr. Schwartz calculates Tinder's and OkCupid's damages of [redacted] and [redacted] respectively, for total damages of [redacted][291] Using an "alternative competitive Android digital IAP processing rate" (i.e., 4.8%) and for the damages period from 7/7/2017-12/31/2021, Dr. Schwartz calculates Tinder's and OkCupid's damages of [redacted] and [redacted], respectively, for total damages of [redacted].[292] Under Dr. Schwartz's Base Case and for the alternative damages period from 5/9/2018-12/31/2021, Dr. Schwartz calculates

287 Schwartz Report, ¶ 425.
288 Schwartz Report, ¶ 456.
289 Schwartz Report, ¶ 456.
290 Schwartz Report, ¶ 456.
291 Schwartz Report, ¶ 480, Table 5.
292 Schwartz Report, ¶ 481, Table 6.

Tinder's and OkCupid's damages of [redacted] and [redacted], respectively, for total damages of [redacted]. Using the alternative competitive IAP processing rate and for the alternative damages period from 5/9/2018-12/31/2021, Dr. Schwartz calculates Tinder's and OkCupid's damages of [redacted] and [redacted] respectively, for total damages of [redacted][293] I note that Dr. Schwartz also estimates damages for the period from 1/1/2022-5/20/2022. These damages amount to [redacted] for Dr. Schwartz's Base Case and [redacted] for Dr. Schwartz's alternative scenario based on the higher IAP processing rate of 4.8%.[294]

203. An important implication of Dr. Schwartz's Damages Model is that in the but-for world, Dr. Schwartz assumes that the Match Plaintiffs would not have passed on any of the lower but-for service fee to consumers. This is directly inconsistent with Dr. Singer and Dr. Rysman, both of whom assume substantial pass-on would have occurred.[295] Given that consumers (including the named Plaintiffs) have Tinder, OkCupid, and other of the Match Plaintiffs' apps, awarding both Dr. Schwartz's damages and the consumer damages would amount to awarding the same damages to two different parties.

B. Dr. Schwartz's Damages Model Suffers from Several Fundamental Flaws

204. Dr. Schwartz's Damages Model suffers from several fundamental flaws that renders his calculation of damages inaccurate and unsupported.

205. First, the internal Google Tinder Play Value Estimate and Play Value Model analyses on which Dr. Schwartz relies to assess the value of Play (i.e., Discovery Value and Delivery Value) to Tinder and OkCupid for his damages calculation are inappropriate to use for purposes of

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[293] Schwartz Report, ¶ 482, Table 7.
[294] Schwartz Report, ¶ 485, Table 8.
[295] In fact, Dr. Singer actually calculates a pass-through rate for Tinder of [redacted] to [redacted]. See Singer Report, fn. 851.

calculating economic damages in this matter because they do not account for all sources of value that Play provides to app developers, including the Match Plaintiffs. According to Michael Marchak, Director of Play Partnerships, Strategy and Operations, [redacted] that Dr. Schwartz uses in his Damages Model, Mr. Marchak states that [redacted][297] and that it is [redacted][298] Thus, even if one were to accept Dr. Schwartz's claim that Google's calculation of Play's value to the Match Plaintiffs would have been the starting point of negotiations over a fee for that value, Google's starting point for negotiations would have accounted for all of Play's value and not just [redacted]. Dr. Schwartz ignores this shortcoming of the Play Value Model, which has the effect of overstating his damages. Furthermore, although Dr. Schwartz uses Google's Play Value Model and the Tinder-specific Play Value Estimate as his "starting point" for damages, it also ends up being his "end point" for damages. In doing so, Dr. Schwartz does not adjust his "starting point" to reflect any of the case-specific circumstances regarding the negotiating positions of the Match Plaintiffs and Google and, most importantly, does not adjust for the limitations in using Google's Play Value Model to calculate damages, including that the model does not account for many features of Play that provide value to app developers. Furthermore, Dr. Schwartz does not account for any of the other iterations of Google's Play Value Model. As I demonstrate below, using other versions of

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[296] Deposition of Michael Marchak, January 12, 2022, ("Marchak Dep.") at 24:4-7, 104:23-25.
[297] Marchak Dep. at 296:1-5.
[298] Marchak Dep. at 301:6-10.

Google's Play Value Model as the "starting point" for negotiations results in substantially lower (and in some cases negative) damages for the Match Plaintiffs.

206. Second, Dr. Schwartz's damages theory is premised on the concept that each app developer at each point in time should have paid Google exactly the value Play offered it at that point in time in the but-for world. This would have had a significant impact on costs for many developers: Google would have charged some app developers a higher fee than they currently pay because the value they receive from Play, particularly the Discovery Value, is larger than the service fee that Google currently charges. For example, in Google's December 2021 version of the Play Value Model, addressed in a presentation titled, "Play Developer Benefits: Progress update + Insights," [redacted][299] In Google's August 2019 version of the Play Value Model, which Dr. Schwartz relies on for his Match Plaintiffs' damages calculation, [redacted][300] Furthermore, although Google does not charge any service fee for apps that do not have any sales, under Dr. Schwartz's damages theory all app developers would have had to pay for their Discovery Value regardless of their sales. Thus, Dr. Schwartz's logic implies that Google would have potentially charged service fees to

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[299] GOOG-PLAY-011023692 at 712.
[300] GOOG-PLAY-000337564 at 606.

developers of free and ad-supported apps. For new apps, Play likely offers significant Discovery Value early in the lifecycle that is much larger than Google's current service fee. Again, in Dr. Schwartz's but-for world these app developers would likely have had to pay higher service fees early in their apps' lifecycles.

207. Third, Dr. Schwartz's damages theory is also premised on the fact that Play had little value to the Match Plaintiffs, given the relatively small amounts he calculates for Play's Discovery and Delivery Value to Tinder and OkCupid, and that in the but-for world the "Match Plaintiffs would have been able to negotiate with Google prices for Android app distribution that would have been more commensurate with the value Match Plaintiffs derived from such services."[301] The value that the Match Plaintiffs derive from Play—in particular, Tinder and OkCupid—is demonstrated by their voluntary decision to provide Play as an option when they could have switched to an alternative, such as their own website, and thereby avoided the Play service fee. If Play was not particularly valuable to the Match Plaintiffs, paying the 30% fee when they could have left Play behind makes no economic sense. Sharmistha Dubey, Former CEO and current Board Member of MGI, [redacted][302] Indeed, it is likely that the Match Plaintiffs would have lost revenues if they stopped using Google Play's billing system or removed their apps from Play altogether. According to Dr. Schwartz, who relied on a discussion with Ms. Dubey, Tinder continued to include Google Play's billing system as a payment processing option even when it

[301] Schwartz Report ¶ 390.

[302] Deposition of Sharmistha Dubey, October 13, 2022 at 213:16-214:3.

began offering its own IAP system because [redacted][303] Relatedly, under Dr. Singer's view of the but-for world, Play would retain an approximate 60% share even when competing with other payment processing systems.[304] Thus, if the Match Plaintiffs had removed their apps from Play, their revenues associated with the consumers who stayed on Play would have been at risk. Moreover, the Match Plaintiffs may have feared that if they changed their billing and distribution systems, a significant share of their subscribers may have been prompted to cancel their subscriptions.[305] Finally, the Match Plaintiffs update their apps frequently in order to drive user engagement and these updates are distributed through Play.[306] The Match Plaintiffs would have risked disruption in their business strategies if they had moved their apps out of Play. A plausible explanation for the Match Plaintiffs' decision to stay in Play is that the store delivered value that exceeded the Google Play service fee.

208. Fourth, Dr. Schwartz's Damages Model does not account for any of the Discovery Value or Delivery Value that Play provided to Tinder or OkCupid prior to the damages period when Google distributed these apps for free through Play. As noted above, an app may have much higher Discovery Value or Delivery Value early in its lifecycle than later, but higher sales late in its lifecycle than earlier. Google has chosen to implement a pricing system for Play that effectively

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[303] Schwartz Report ¶ 371. Dr. Schwartz also claims that Tinder was concerned that Google would retaliate if it did not offer GPB as a payment processing option, but offers no evidence to support such a claim.

[304] Singer Report, fn. 686.

[305] Deposition of Adrian Ong, October 14, 2022, Exhibit 928 (MATCHGOOGLE00087739).

[306] Declaration of Peter Foster In Support of Plaintiffs' Motion for Temporary Restraining Order, May 10, 2022, ¶ 54 ("Match Group frequently updates its apps to, among other things, implement new software, improve functionality, address bugs, and enhance security. Match Group submits app updates to Google for review and approval").

holds off on charging an app until later in the lifecycle when it is generating greater sales. Dr. Schwartz's approach to damages would allow the Match Plaintiffs to exploit this fundamental nature of Google's pricing system to free-ride on the Discovery Value and Delivery Value that Play provided to the Match Plaintiffs prior to the damages period. Eliminating the free-ride would substantially reduce or eliminate Match Plaintiffs' claimed damages.

209. Fifth, although Dr. Schwartz's characterization of the but-for world is predicated on the assumption that Google would have charged app developers two separate fees—one fee for Google Play's billing system and another fee for Play[307]—Dr. Schwartz fails to account for the Discovery Value and Delivery Value received by the Match Plaintiffs' other apps (such as Match, PlentyofFish, and OurTime) in the but-for world from Play. According to Dr. Schwartz's characterization of the but-for world, Google would still need to be compensated for the Discovery Value and Delivery Value provided by Play (separate from the value provided by Google Play's billing system), and there is no reason why Dr. Schwartz's Damages Model should ignore the Discovery Value and Delivery Value received by all of the Match Plaintiffs' apps. However, Dr. Schwartz's Damages Model does not account for the Match Plaintiffs' other apps' but-for Discovery Value and Delivery Value for revenues they realized as a result of Play and, therefore, his damages are overstated and unreliable.

210. Finally, Dr. Schwartz's Damages Model fails to account for the increased costs that Match Plaintiffs (and other developers) would have incurred in the but-for world. For example, to distribute apps through a larger set of app stores that might have existed in the but-for world, Match

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[307] Schwartz Report, ¶ 476 ("in the but-for world, Tinder and OkCupid would still have compensated Google for the Discovery Value and Delivery Value and would have paid a competitive rate for IAP processing services").

Plaintiffs would have had to incur the transaction costs associated with negotiating with each store and meeting the store's compliance requirements. Dr. Schwartz's Damages Model does not incorporate any such costs. Additionally, Google could have chosen to charge service fees to free and ad-supported apps in the but-for world. This would have adversely affected Match Plaintiffs. Again, Dr. Schwartz does not address any of these potential costs to the Match Plaintiffs.

C. Dr. Schwartz's Damages Model Understates the Discovery Value and Delivery Value That the Match Plaintiffs Receive from Play

1. The Purpose of the Play Value Models Relied on by Dr. Schwartz Is Not To Produce a Specific or Exact Valuation of Play

211. As previously discussed, Dr. Schwartz's Damages Model relies on Google's Tinder Play Value Estimate,[308] prepared in June 2019, and Google's Play Value Model,[309] prepared in August 2019, to quantify the Discovery Value and Delivery Value that Tinder and OkCupid would have received from Play in the but-for world. However, Dr. Schwartz's use of these internal Google analyses in his Damages Model results in an unreliable calculation of damages.

212. First and foremost, Dr. Schwartz claims to use the results of Google's Play Value Model applied to Tinder as a "starting point" for negotiations between Google and the Match Plaintiffs. In other words, Dr. Schwartz proposes a bargaining model where Google would have used the results of its Play Value Model to begin the process of determining the appropriate service fee for the value provided by Play to the Match Plaintiffs. However, it makes no sense that Google would have ultimately concluded its negotiations with the Match Plaintiffs by settling at the exact lowest possible value of Play that it believes is provided to the Match Plaintiffs, as Dr. Schwartz claims.

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[308] GOOG-PLAY-011274244.

[309] GOOG-PLAY-000337564.

Rather, the actual end point of the bargaining between Google and the Match Plaintiffs would likely have been at a much higher value for Play as demonstrated by the numerous other iterations of the Play Value Model that Dr. Schwartz conveniently chose to ignore without explanation. A higher value for Play is also supported by the fact that Google's Play Value Model understates the value of Play because it does not account for all of the features that Play provides to Tinder, OkCupid, and the other Match Plaintiffs' apps.

213. Second, according to Mr. Marchak, a member of the team that has worked on Google's Play Value Model since its beginning, the initial motivation of the project was [redacted][311] Furthermore, the results of the Play Value Model were used for [redacted][312] Based on a conversation with Google personnel familiar with the Play Value Model, its initial purpose was [redacted] Over time there have been many iterations of the Play Value Model, with additional features added to the valuation exercise; however, even the latest version of the model does not capture the value of all the features of Play. Furthermore, the purpose of the model [redacted]

[310] Marchak Dep. at 35:11-13.
[311] Marchak Dep. at 36:17-37: 2.
[312] Marchak Dep. at 38:5-6.

[redacted]. Google has also generally been very conservative in the assumptions it has used in the model, which has generated results that understate the complete value of Play to app developers.[313]

214. Third, the underlying data and calculations supporting Google's Play Value Model also provide an indication of how the model is intended to be used: [redacted][314] Additionally, what I understand to be the most recent iteration of Google's Play Value Model, which is discussed in the December 2021 presentation titled, [redacted] also addresses the applicability of Google's Play Value Model: [redacted][315]

215. Fourth, I understand that Google's June 2019 Tinder Play Value Estimate of [redacted] that was specifically used by Dr. Schwartz in his Damages Model was based on the application of just one version of the Play Value Model. I further understand that around this time Google was consistently modifying and refining the Play Value Model by incorporating and testing different

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[313] Discussion with Krishna Shrinivas, Head of Research and Insights, Android and Play Strategy, November 14, 2022.
[314] GOOG-PLAY-004625919.
[315] GOOG-PLAY-011023692 at 692.

assumptions about the drivers of Play value, which resulted in a wide range of results produced by the model.[316] For example, in the same June 2019 Tinder Play Value Estimate, Google calculated a Tinder Play Value Estimate of [redacted].[317] Just two months later, in August 2019, Google calculated Tinder Play Value Estimates of [redacted][318] Furthermore, Sarah Karam, the Global Head of Apps and Partnerships of Google Play in June 2019 who worked with the team involved in the estimation of Tinder's value from Play at that time, confirms that Google was [redacted][319] Additionally, [redacted][320] Thus, simply relying on just one iteration of the Tinder Play Value Estimate, particularly at a time when the Google Play Value Model was in its initial stages, constantly changing, and only quantified a portion of the total value that Play offered to app developers, is inappropriate for purposes of a damages calculation and, therefore, generates unreliable results.

216. Therefore, given the purpose of the Play Value Model in general, and the versions of this model that address the purported value of Play to Tinder and OkCupid (i.e., the Tinder Play Value Estimate and related documents), it is inappropriate for Dr. Schwartz to rely on the results of just one of these models, and not to perform any of the necessary adjustments, to quantify the Match

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[316] Discussion with Krishna Shrinivas, Head of Research and Insights, Android and Play Strategy, November 14, 2022.

[317] GOOG-PLAY-011274244 at 250.

[318] GOOG-PLAY-000337564 at 580; GOOG-PLAY-004625919, "data" tab.

[319] Deposition of Sarah Karam, September 28, 2022, ("Karam Dep.") at 121:20-122:5.

[320] Karam Dep. at 122:12-21.

Plaintiffs' damages in this matter. This is a particularly critical flaw in Dr. Schwartz's Damages Model because, as I discuss in the next section, the Play Value Model significantly understates the value of Play to app developers because it does not account for all of the services provided by Play.

2. The Play Value Models Relied on by Dr. Schwartz Understate the Value That the Match Plaintiffs Receive from Play Because They Do Not Quantify the Value of All Play Services

217. Google's Tinder Play Value Estimate and Play Value Model are also unreliable for calculating damages in this matter because both internal Google analyses make it clear that they do not quantify the value of all services provided through Play. As a result, by not accounting for the value of all Play services, Dr. Schwartz's Damages Model understates the but-for Discovery Value and Delivery Value that Tinder and OkCupid receive from Play and, therefore, overstates the Match Plaintiffs' alleged damages.

218. For example, according to Google's Tinder Play Value Estimate:

> [redacted] that we do with them that Tinder has told us they value and care about. [redacted][321]

Additionally, according to the slide titled, [redacted]

[redacted] [redacted]

[321] GOOG-PLAY-011274244 at 244.

[redacted][322]

The notes corresponding to this slide indicate [redacted][323]

219. The underlying data and calculations supporting Google's Play Value Model also indicate that the model does not capture the value of all services provided to developers: [redacted][324]

220. Finally, Google's most recent iteration of its Play Value Model from December 2021 addresses [redacted]

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[322] GOOG-PLAY-000337564 at 572. See also the slide titled, "Reminder: Value model does not account for all the ways Play creates value." GOOG-PLAY-000337564 at 590.

[323] GOOG-PLAY-000337564 at 573, 591.

[324] GOOG-PLAY-004625919.

[redacted][327] According to Google: [redacted][330]

221. In summary, Google's Play Value Model, Tinder Play Value Estimate, and supporting materials make it clear that not all Play services are accounted for in the analyses. Therefore, the results of these models understate the value of Play, particularly the Discovery Value, to app developers such as Tinder and OkCupid. This results in an understatement of Dr. Schwartz's calculation of Tinder's and OkCupid's but-for Discovery Value and Delivery Value and a

[325] GOOG-PLAY-011023692 at 692. Throughout the presentation, including on the Executive Summary slide, there is a caveat that states: [redacted] GOOG-PLAY-011023692 at 705.

[326] GOOG-PLAY-011023692 at 695.

[327] GOOG-PLAY-011023692 at 706.

[328] GOOG-PLAY-011023692 at 706.

[329] GOOG-PLAY-011023692 at 707.

[330] GOOG-PLAY-011023692 at 708.

corresponding overstatement of Match Plaintiffs' damages. This is a fundamental flaw in Dr. Schwartz's Damages Model.

3. Dr. Schwartz Ignores Other Versions of the Play Value Models That If Used In His Damages Model Would Reduce the Match Plaintiffs' Damages

222. Dr. Schwartz relies on one version of Google's Play Value Model, the June 2019 Tinder Play Value Estimate, to calculate the Match Plaintiffs' damages and does not explain why he chose to use this version over at least three additional iterations of the model applicable to Tinder. The version of the Tinder Play Value Estimate used by Dr. Schwartz in his Damages Model has the lowest Tinder and OkCupid Play Value and Discovery Value, and results in the highest damages for the Match Plaintiffs. As I illustrate below, using the alternative versions of Google's Play Value Model for Tinder (and in some instances OkCupid) in Dr. Schwartz's Damages Model would significantly lower the Match Plaintiffs' damages. These alternative versions of Google's Play Value Model, which Dr. Schwartz chose to ignore without any explanation, include the following:

- Tinder Play Value Estimate
    - Dr. Schwartz relies on the [redacted] in this model that generates a Tinder Play Value of [redacted] of [redacted][331] [redacted]
    - **Alternative CPI Valuation #1**: This model also provides an [redacted] that generates a [redacted].[332]
- Play Value Model

[331] GOOG-PLAY-011274244 at 246. This version of the model also generates [redacted] GOOG-PLAY-011274244 at 247. I note that without explanation Dr. Schwartz ignores the OkCupid valuation in his Damages Model and instead relies on the Tinder valuations to estimate similar values for OkCupid.

[332] GOOG-PLAY-011274244 at 250.

- **Alternative CPI Valuation #2**: [redacted][333]
- **Alternative LTV Valuation #1**: [redacted].[334] LTV stands for "lifetime value."

223. Dr. Schwartz uses the initial [redacted] in the Tinder Play Value Estimate and adjusts the [redacted][335] I understand that [redacted][336] Furthermore, according to Google, [redacted][337] In contrast, the initial [redacted] in the Tinder Play Value Estimate that Dr. Schwartz uses in his Damages Model, identified as a [redacted]

[333] GOOG-PLAY-000337564 at 580; GOOG-PLAY-004625919.

[334] GOOG-PLAY-000337564 at 580; GOOG-PLAY-004625919.

[335] Schwartz Report, ¶ 459. [redacted] GOOG-PLAY-004625919; GOOG-PLAY-000337564 at 578.

[336] Discussion with Krishna Shrinivas, Head of Research and Insights, Android and Play Strategy, November 14, 2022.

[337] GOOG-PLAY-000337564 at 578.

[redacted][338]

224. Therefore, Dr. Schwartz's decision to rely on only one version (and the most aggressive version in terms of damages) of Google's Play Value Model for Tinder, to adjust this version of the model from [redacted], and to ignore other [redacted] versions of Tinder's Play Value Model is unsupported. As I discuss below, I have implemented all available versions of Google's Play Value Model for Tinder in to Dr. Schwartz's Damages Model to demonstrate the effect that these alternative models have on his calculation of [redacted] and, ultimately, damages.

D. Dr. Schwartz's Damages Model Suffers from Several Errors Related to His Treatment of the Google Transaction Data

225. Dr. Schwartz committed several errors in his processing of Google's transaction data, which I have outlined below:

- Inclusion of Canceled Transactions
  - I understand that only transactions with a "delivery_state" value of "DELIVERED" and a "payment_state" value of "CHARGED" are considered to be completed transactions and the rest are considered to be canceled. Dr. Schwartz includes in his analysis transactions with a variety of "delivery_state" and "payment_state" values. For example, he includes transactions with a "payment_state" of "CANCELED." As these transactions are not considered completed transactions, Dr. Schwartz's inclusion of them in his analysis is inappropriate.[339]
- Inclusion of Test Transactions
  - I understand that transactions that have the value of "TEST_INSTRUMENT" or "NO_INSTRUMENT" in the "instrument_details" field are test transactions implemented by Google for internal purposes. Dr. Schwartz includes in his analysis transactions that

[338] GOOG-PLAY-000337564 at 578.

[339] See B. Rocca Letter to Plaintiffs re Transactional Data, August 23, 2022.

meet these criteria. As these test transactions are not considered completed transactions, Dr. Schwartz's inclusion of them in his analysis is inappropriate.[340]

- Failure to Convert Non-US Currencies to US Dollars
  - I understand that the field "sale_revenue_pricing.total_amount" displays the currency in which each transaction was paid, and that the value of "USD" indicates that a given transaction was paid with US dollars. Dr. Schwartz includes transactions with over 40 different currencies and erroneously does not convert them into U.S. dollars for his analysis.[341]
- Inclusion of Transactions with Zero Unit Price
  - I understand that transactions with a unit price of zero do not incur transaction fees. Dr. Schwartz erroneously includes in his analysis these zero-price transactions and assigns them transaction fees.[342]
- Exclusion of Certain Transactions
  - There are a number of transactions missing from Dr. Schwartz's analysis that are present in the underlying Google transaction data. I have investigated and am unaware of any reason these transactions should have been excluded from Dr. Schwartz's analysis.

In total, Dr. Schwartz's errors in his treatment of the Google transaction data account for [redacted] in revenue and [redacted] transactions in Attachment X-6 of his report. I note that for the sensitivities discussed in the following section I use an updated version of Attachment X-6 that corrects for the errors enumerated above.

E. Sensitivity Analysis of Dr. Schwartz's Damages Model

1. Correcting Dr. Schwartz's [redacted] Adjustment

226. Dr. Schwartz's damages analysis for Tinder begins with the [redacted] presented in the Tinder Play Value Estimate. Dr. Schwartz then applies an adjustment of

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[340] See B. Rocca Letter to Plaintiffs re Transactional Data, January 14, 2022.

[341] See backup materials to this report.

[342] See backup materials to this report. While Google does not charge service fees for orders with zero unit price, it is unclear whether third-party payment processing providers would charge a transaction fee for such transactions. Thus, to be conservative, I assume that these transactions would not be subject to any service fees and do not include them in my analysis.

[redacted] to this figure based on the [redacted] Specifically, he applies the [redacted] adjustment to the [redacted] Then he subtracts from this figure the [redacted] This figure is a critical input for Dr. Schwartz's calculation of Tinder's Discovery Value in the but-for world and for Dr. Schwartz's calculation of OkCupid's Discovery Value in the but-for world, which starts with the Tinder [redacted] and then performs some further adjustments to transform it into an OkCupid figure.[343]

227. However, Dr. Schwartz could have performed his adjustment with the more detailed information presented in the Excel spreadsheet that provides the underlying data and calculations supporting the figures presented in the Play Value Model.[344] Specifically, the underlying data and calculations provide the Tinder Discovery Values corresponding to the [redacted] [redacted] [redacted] presented in the Play Value Model and which are used by Dr. Schwartz to calculate his [redacted] [redacted] adjustment.[345] Rather than using the [redacted] [redacted] adjustment based on data at the Play Value level, Dr. Schwartz should have calculated a more accurate [redacted] adjustment at the Discovery Value level using

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343 Schwartz Report, ¶¶ 458-459. See also Schwartz Report, Attachment D-3.

344 GOOG-PLAY-004625919.

345 GOOG-PLAY-004625919, "data" tab.

the Discovery Value figures in the underlying data and calculations of the Play Value Model. I note that Dr. Schwartz does not explain why he chose to ignore this more relevant data.

228. Using the underlying data and calculations of the Play Value Model, I have calculated a more accurate [redacted] adjustment as follows:

[redacted]

Applying the more accurate [redacted] adjustment of [redacted] to the [redacted] from the Tinder Play Value Estimate generates an estimated [redacted] (versus [redacted] based on Dr. Schwartz's calculation). Dividing [redacted] by [redacted] Google Play Tinder Installs during the Q1 2018 to Q1 2019 period results in [redacted] (versus [redacted] based on Dr. Schwartz's calculation).

229. The first sensitivity analysis of Dr. Schwartz's damages that I perform involves replacing Dr. Schwartz's Baseline Tinder [redacted] with the [redacted] calculated above. Doing so results in the Match Plaintiffs' damages figures presented in Table 17 (Dr. Schwartz's original Match Plaintiffs' damages figures are presented in italics).

Table 17. Sensitivity Analysis #1: Summary of Match Plaintiffs' Damages Correcting Dr. Schwartz's [redacted] Adjustment

[redacted]

Source: See Exhibit 25.

2. Removing Dr. Schwartz's [redacted]

230. As discussed above, I understand that internally Google does not view the [redacted] Play Value Model as better than the other. Furthermore, each version of the Play Value Model has its advantages and disadvantages.[346] Therefore, there is no reasonable justification for Dr. Schwartz adjusting the [redacted] in the Tinder Play Value Estimate to an [redacted]

231. I have removed Dr. Schwartz's [redacted] and, alternatively, have used the Tinder [redacted] of [redacted] presented in the Tinder Play Value Estimate (versus Dr. Schwartz's adjusted [redacted] figure). Dividing [redacted] by [redacted] Google Play Tinder Installs during the Q1 2018 to Q1 2019 period results in a [redacted] (versus [redacted] based on Dr. Schwartz's calculation).

232. The second sensitivity analysis of Dr. Schwartz's damages that I perform involves replacing Dr. Schwartz's [redacted] with

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[346] GOOG-PLAY-000337564 at 578.

the [redacted] calculated above. Additionally, I replaced Dr. Schwartz's Baseline OkCupid [redacted] which he calculates based on the Baseline Tinder [redacted] with a more accurate and direct calculation of this figure. Specifically, I use the [redacted] presented in the Tinder Play Value Estimate and divide this figure by [redacted]s during the Q1 2018 to Q1 2019 period to calculate a [redacted] (versus [redacted] based on Dr. Schwartz's calculation). Doing so results in the Match Plaintiffs' damages figures presented in Table 18 (Dr. Schwartz's original Match Plaintiffs' damages figures are presented in italics).

Table 18. Sensitivity Analysis #2: Summary of Match Plaintiffs' Damages Removing Dr. Schwartz's [redacted] Adjustment

[redacted]

Source: See Exhibit 25.

3. Dr. Schwartz Ignores Other [redacted] Play Value Models

a. Tinder Play Value Estimate

233. In the Tinder Play Value Estimate relied on by Dr. Schwartz there is an [redacted] Play Value Model.[347] This alternative Play Value Model provides a Tinder [redacted]

[347] GOOG-PLAY-011274244 at 249-252.

[redacted] of [redacted] and an estimated OkCupid [redacted] of [redacted][348] I refer to this valuation as the Alternative [redacted] Valuation #1.

234. Applying the more accurate [redacted] adjustment of [redacted] to the Tinder [redacted] of [redacted] million generates an estimated Tinder [redacted] of [redacted] (versus [redacted] based on Dr. Schwartz's calculation). Dividing [redacted] by [redacted] Google Play Tinder Installs during the Q1 2018 to Q1 2019 period results in a [redacted] of [redacted] (versus [redacted] based on Dr. Schwartz's calculation).

235. The third sensitivity analysis of Dr. Schwartz's damages that I perform involves replacing Dr. Schwartz's [redacted] with the [redacted] calculated above. Doing so results in the Match Plaintiffs' damages figures presented in Table 19 (Dr. Schwartz's original Match Plaintiffs' damages figures are presented in italics). Given that the total damages figures are negative, under this scenario the Match Plaintiffs suffered no damages and, in fact, received more value from Play in the but-for world than the actual service fees paid.

[348] GOOG-PLAY-011274244 at 250.

Table 19. Sensitivity Analysis #3: Summary of Match Plaintiffs' Damages Alternative [redacted] Valuation #1 and Correcting Dr. Schwartz's [redacted] Adjustment

[redacted]

Source: See Exhibit 25.

236. I have also performed a sensitivity analysis where I use the Tinder [redacted] of [redacted] and OkCupid [redacted] of [redacted] but do not apply Dr. Schwartz's [redacted] adjustment. Dividing [redacted] by [redacted] Google Play Tinder Installs during the Q1 2018 to Q1 2019 period results in a [redacted] (versus [redacted] based on Dr. Schwartz's calculation). Dividing [redacted] by [redacted] Google Play OkCupid Installs during the Q1 2018 to Q1 2019 period results in a [redacted] (versus [redacted] based on Dr. Schwartz's calculation).

237. The fourth sensitivity analysis of Dr. Schwartz's damages that I perform involves replacing Dr. Schwartz's [redacted] with the [redacted] calculated above, and replacing Dr. Schwartz's [redacted] with the [redacted] calculated above. Doing so results in the Match Plaintiffs' damages figures presented in Table 20 (Dr. Schwartz's original Match Plaintiffs' damages figures are presented in italics). Given that the total damages figures are negative, under

this scenario the Match Plaintiffs suffered no damages and, in fact, received more value from Play in the but-for world than the actual service fees paid.

Table 20. Sensitivity Analysis #4: Summary of Match Plaintiffs' Damages Alternative [redacted] Valuation #1 and Removing Dr. Schwartz's [redacted] Adjustment

[redacted]

Source: See Exhibit 25.

b. Play Value Model and Underlying Data and Calculations

238. In the Play Value Model relied on by Dr. Schwartz to perform his [redacted] there is an [redacted] Play Value Model for Tinder.[349] In the underlying data and calculations for this version of the model, the [redacted] Play Value Model provides a [redacted][350] I refer to this valuation as the [redacted] Valuation #2. Despite having access to this version of the Play Value Model for Tinder, and the underlying data and calculations that provide the [redacted] components of the Total Play Value, Dr. Schwartz does not rely on this [redacted] version of the model nor does he explain why he chose to ignore it.

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[349] GOOG-PLAY-000337564 at 580; GOOG-PLAY-004625919, "data" tab.

[350] GOOG-PLAY-004625919, "data" tab. I note that there is no corresponding OkCupid [redacted] provided in this version of the Play Value Model.

239. I have performed a sensitivity analysis where I use the Tinder [redacted] of [redacted] and do not apply Dr. Schwartz's [redacted] Dividing [redacted] by [redacted] Google Play Tinder Installs during the Q1 2018 to Q1 2019 period results in a [redacted] of [redacted] (versus [redacted] based on Dr. Schwartz's calculation). I note that the Tinder Delivery Value in the [redacted] Valuation #2 is [redacted], which is different from the Delivery Value used in Dr. Schwartz's Damages Model of [redacted] Therefore, in this scenario I have also updated the calculation of the [redacted] by dividing [redacted] by [redacted] Google Play Tinder Installs during the Q1 2018 to Q1 2019 period resulting in a per-install figure of [redacted] (versus [redacted] based on Dr. Schwartz's calculation).

240. The fifth sensitivity analysis of Dr. Schwartz's damages that I perform involves replacing Dr. Schwartz's [redacted] with the [redacted] calculated above, and replacing Dr. Schwartz's [redacted] with the [redacted] calculated above. Doing so results in the Match Plaintiffs' damages figures presented in Table 21 (Dr. Schwartz's original Match Plaintiffs' damages figures are presented in italics). Given that the total damages figures are negative, under this scenario the Match Plaintiffs suffered no damages and, in fact, received more value from Play in the but-for world than the actual service fees paid.

Table 21. Sensitivity Analysis #5: Summary of Match Plaintiffs' Damages Alternative [redacted] Valuation #2 and Removing Dr. Schwartz's [redacted] Adjustment

[redacted]

Source: See Exhibit 25.

4. Dr. Schwartz Ignores Other LTV-Based Play Value Models

241. In the Play Value Model relied on by Dr. Schwartz to perform his [redacted] adjustment there is also an [redacted] Play Value Model for Tinder.[351] In the underlying data and calculations for this version of the model, the [redacted] Play Value Model provides a Tinder [redacted] of [redacted][352] I refer to this valuation as the [redacted] Valuation #1. As discussed above, despite having access to this version of the Play Value Model for Tinder, and the underlying data and calculations that provide the [redacted] components of the Total Play Value, Dr. Schwartz does not rely on this [redacted] version of the model nor does he explain why he chose to ignore it.

242. I have performed a sensitivity analysis where I use the Tinder [redacted] Value of [redacted] and given that this analysis already begins with an [redacted] Value there is no need to apply any [redacted] adjustment. Dividing [redacted] by [redacted] Google

[351] GOOG-PLAY-000337564 at 580; GOOG-PLAY-004625919, "data" tab.

[352] GOOG-PLAY-004625919, "data" tab. I note that there is no corresponding OkCupid LTV Discovery Value provided in this version of the Play Value Model.

Play Tinder Installs during the Q1 2018 to Q1 2019 period results in a [redacted] (versus [redacted] based on Dr. Schwartz's calculation). I note that the Tinder Delivery Value in the [redacted] Valuation #1 is [redacted] which is different from the Delivery Value used in Dr. Schwartz's Damages Model of [redacted] Therefore, in this scenario I have also updated the calculation of the Baseline Tinder Delivery Value per Install by dividing [redacted] by [redacted] Google Play Tinder Installs during the Q1 2018 to Q1 2019 period resulting in a per-install figure of [redacted] (versus [redacted] based on Dr. Schwartz's calculation).

243. The sixth, and final, sensitivity analysis of Dr. Schwartz's damages that I perform involves replacing Dr. Schwartz's [redacted] with the [redacted] calculated above, and replacing Dr. Schwartz's [redacted] with the [redacted] calculated above. Doing so results in the Match Plaintiffs' damages figures presented in Table 22 (Dr. Schwartz's original Match Plaintiffs' damages figures are presented in italics).

Table 22. Summary of Match Plaintiffs' Damages
Alternative [redacted] Valuation #1 and Removing Dr. Schwartz's [redacted] Adjustment

[redacted]

Source: See Exhibit 25.

F. Alternative Match Plaintiffs' Damages

244. I have performed an alternative calculation of the Match Plaintiffs' damages that incorporates but-for service fees consistent with those discussed earlier in this report (i.e., I assume that the current service fee rate structure would have been adopted at or before the start of the damages period). Therefore, for my alternative damages calculation the but-for service fee rate for the Match Plaintiffs' subscription revenues processed through Google Play's billing system is 15% for the entire damages period.[353] The but-for service fee rate for the Match Plaintiffs' IAP revenues processed through Google Play's billing system is 15% for the first $1 million of annual sales and 30% for the remaining sales in each year for the entire damages period. Applying these but-for service fee rates to the Match Plaintiffs' subscription and IAP revenues processed through Google Play's billing system[354] and subtracting them from the service fees the Match Plaintiffs actually paid results in the alternative Match Plaintiffs' damages figures presented in Table 23 (Dr. Schwartz's original Match Plaintiffs' damages figures are presented in italics).

245. Given that I assume the current service fee rate structure would have been adopted at or before the start of the damages period, in the but-for world the Match Plaintiffs would not only pay service fees for its subscription and IAP revenues processed through Google Play's billing system but also for its subscription and IAP revenues processed through third-party payment processing systems for apps purchased in Play, namely when the Match Plaintiffs utilize their own respective payment processors on Android. I understand that in South Korea and the European Economic Area ("EEA"), Google currently offers a 3-4 percentage points discount on service fees

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[353] I adopt Dr. Schwartz's damages periods for this calculation.

[354] OkCupid, Plenty of Fish (also "POF"), and Tinder are the only Match Plaintiffs' apps to have processed revenues through Google Play's billing system.

for revenues processed through third-party payment processing systems,[355] and I have assumed that Google would have offered a 4 percentage points discount in the but-for world, starting at the beginning of the damages periods. Thus, any damages calculated based on an overcharge of Match Plaintiffs' revenues processed through Google Play's billing system should be offset by the additional fees Match Plaintiffs would owe Google associated with revenues processed through third-party payment processing systems. For subscription revenues processed through third-party payment processing systems, the but-for service fee rate for the Match Plaintiffs' subscription revenues is 11% (15%-4%=11%) for the entire damages period.[356] The but-for service fee rate for the Match Plaintiffs' IAP revenues processed through third-party payment processing systems is 11% (15%-4%=11%) for the first $1 million of annual sales and 26% (30%-4%=26%) for the remaining sales in each year for the entire damages period. Applying these but-for service fee rates to the Match Plaintiffs' subscription and IAP revenues processed through third-party billing systems[357] and subtracting the resulting figures from the damages calculated associated with revenues processed through Google Play's billing system results in the alternative Match Plaintiffs' damages figures presented in Table 23 (Dr. Schwartz's original Match Plaintiffs' damages figures are presented in italics).

[355] "Changes to Google Play's Billing Requirements for Developers Serving Users in South Korea," Google, https://support.google.com/googleplay/android-developer/answer/11222040; "An Update on Google Play Billing in the EEA," Google, July 19, 2022, https://blog.google/around-the-globe/google-europe/an-update-on-google-play-billing-in-the-eea/.

[356] I adopt Dr. Schwartz's damages periods for this calculation.

[357] Data availability permitting, I include all of the Match Plaintiffs' apps that used third-party payment processors over the course of the damages period in my calculations.

Table 23. Alternative Match Plaintiffs' Damages

[redacted]

Source: See Exhibits 25, 33a-33d.

246. The negative total damages figures in Table 23 above indicate that, in this construction of the but-for world, the Match Plaintiffs would owe more as service fees on Android revenue that was processed through third-party payment processors than what the Match Plaintiffs were overcharged on revenue processed through Google Play's billing system. Since I applied the current rate structure for the entire damages period, this analysis again demonstrates that the Match Plaintiffs' actual fees paid to Google likely understate the amount of value they actually received from Play during the damages period.

G. Dr. Schwartz Makes Unsupported Claims In An Attempt to Support His Damages Model

1. Dr. Schwartz Makes Inaccurate Claims Regarding Google's Acknowledgement That Its 30% Fee Is Supracompetitive

247. Dr. Schwartz states that "Google knew it was charging Match Plaintiffs a supracompetitive price,"[358] and "[t]he best evidence that the 30% rate is supracompetitive comes from Google itself."[359] However, the evidence that Dr. Schwartz cites does not support these claims. For example, Dr. Schwartz cites to a slide titled, "Initial learnings from Play value analysis and

[358] Schwartz Report, ¶ 370.

[359] Schwartz Report, ¶ 375.

suggested priorities for Magical Bridge," from a 2019 Google presentation, which states that a [redacted][360] But Dr. Schwartz conveniently ignores the sub-heading below this statement that acknowledges [redacted][361] Therefore, Dr. Schwartz's supposed evidence is misleading because it focuses on developers' "perception" of Play value and the [redacted]

248. As another example, Dr. Schwartz cites a slide titled, "Pros and Cons of Play's current business model," from a September 2020 Google presentation, and only addresses the "Cons," or "Issues we hear …" portion of the slide.[362] The initial issue listed on the slide is [redacted][363] This reflects the "perception" of developers and is not an acknowledgement by Google that it charges a supracompetitive price or believes that the value provided by Play to the Match Plaintiffs is not consistent with the fees paid to Google, as Dr. Schwartz claims. Furthermore, Dr. Schwartz conveniently ignores the "Pros," or "Support for …" portion of the slide, which states the following: [redacted][364] Thus, Dr. Schwartz has presented an incomplete picture of the message that this slide is attempting to present.

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[360] Schwartz Report, ¶ 375; GOOG-PLAY-007328838 at 850.

[361] GOOG-PLAY-007328838 at 850.

[362] Schwartz Report, ¶ 375; GOOG-PLAY-007346079 at 109.

[363] GOOG-PLAY-007346079 at 109.

[364] Schwartz Report, ¶ 375; GOOG-PLAY-007346079 at 109.

249. Dr. Schwartz also cites to a 2019 email from a Google employee that indicates "[redacted][365] Dr. Schwartz does not cite to or address the statement that follows: [redacted][366]

Again, Dr. Schwartz is presenting an incomplete picture of what this slide is attempting to present. Furthermore, given that the Play Value Model for Tinder referred to in this email is incomplete and does not capture the value of several items that Tinder values, it is inappropriate to use this as evidence to support his claim that Google acknowledges that its 30% fee is supracompetitive.

2. Dr. Schwartz Makes Inaccurate Claims About Play's Value to the Match Plaintiffs and How It Is Less Than the Value Enjoyed by the Vast Majority of App Developers

250. Dr. Schwartz makes several claims about Play's value to Match, including as compared to other app developers, and purports to supply evidence from the record that support his claims. In one instance, he states that "Google calculated in 2019 that the 'value share' Tinder receives from GPS is [redacted][367] However, as discussed at length above, this is not an accurate representation of the facts. According to Michael Marchak, Director of Play Partnerships Strategy and Operations, Google's Play Value Model quantifies [redacted][368]

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[365] Schwartz Report, ¶ 375; GOOG-PLAY-007355763 at 763.

[366] GOOG-PLAY-007355763 at 763.

[367] Schwartz Report, ¶ 446.

[368] Marchak Dep. at 24: 4-7, 104: 23-25.

When discussing the specific August 2019 version of Google's Play Value Model that Dr. Schwartz references to support the above claim, Mr. Marchak states that [redacted][369] and that it is [redacted][370] Dr. Schwartz also states that Google "recognizes that this value deficit is driven by the fact that GPS provides little value to Tinder in user acquisition and hence, Discovery." However, the source he uses to support this claim merely states that a potential value misalignment is one of the "Issues [Google] hear[s]" about from developers regarding Play,[371] not that this is something Google as a company accepts to be true. Google has repeatedly indicated, through testimony in this matter and in the source documents themselves, that it does not necessarily believe that such a "value deficit" exists and that attempting to quantify the full value provided by Play to developers is an extremely difficult and dynamic process.

251. Dr. Schwartz also states that when the evidence is "[t]aken as a whole, in the case of the Match Plaintiffs, GPS primarily serves as a tool from which users can download the desired Match Plaintiffs' app to their smartphone."[372] He goes on to claim that "[i]t is the app itself which keeps users engaged and is responsible for delivering content and an experience that users are willing to pay for, and none of that is attributable to Google or GPS."[373] However, Dr. Schwartz fails to consider any evidence relating to the [redacted] (among other types of

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[369] Marchak Dep. at 296: 1-5.

[370] Marchak Dep. at 301: 6-10.

[371] GOOG-PLAY-007346079 at 109.

[372] Schwartz Report, ¶ 453.

[373] Schwartz Report, ¶ 453.

value) that Play provided to Tinder and OkCupid prior to the damages period when Google distributed these apps for free through Play. While Tinder and other Match Plaintiffs' apps may currently have some brand recognition and view Play primarily as a "tool from which users can download" their apps, this was not always necessarily the case, especially during the beginning stages of the app's lifecycle. As noted above, [redacted] By ignoring evidence from early in the Match Plaintiffs' apps' lifecycles, Dr. Schwartz understates the value of Play and renders his claims about its value to Match unreliable. Furthermore, Dr. Schwartz's analysis regarding the share of app acquisitions from categorical searches is unsound. He relies on this analysis as evidence that many of the Match Plaintiffs' users do not discover the apps through categorical searches but search for them specifically in the Play Store, implying [redacted] However, Dr. Schwartz's classification of whether or not specific search terms are considered "categorical" appears to be arbitrary. For example, he classifies the search term "chat app" as categorical but not the search term "chit chat app." He also classifies the search term "cougars dating app" as categorical but not the search term "cougar dating app free." Classifying some terms as categorical while ignoring other nearly identical terms underestimates the implied value of Play to the Match Plaintiffs.

Finally, Dr. Schwartz claims that the evidence demonstrates that "[Google Play store's] value to Match Plaintiffs is less than the value enjoyed by the vast majority of other app developers."[374]

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[374] Schwartz Report, ¶ 445.

However, he provides almost no evidence that discusses the Match Plaintiffs in the context of other app developers. In the case of the few examples of evidence that do mention other app developers, Dr. Schwartz provides no explanation as to how these pieces of evidence imply the Match Plaintiffs are distinct from the "vast majority" of app developers as to the value they receive from Play.

XIII. Conclusions

252. Plaintiffs' experts have failed to describe the but-for world with clarity, which means that their damages calculations—which necessarily rest on predictions of but-for world outcomes—are unsupported. For example, Dr. Rysman's damage calculation rests on the prediction that there would be a large number of additional apps in the but-for world, but he fails to explain where these apps would have come from. Dr. Singer assumes the Google Play store would have had a lower share in the but-for world, but fails to identify which competing stores would have gained share in the but-for world and explain how they would have accomplished those share gains.

253. In addition, Plaintiffs' experts make a number of unsupported and flawed assumptions about other critical inputs to their calculations. For example, Dr. Singer and Dr. Rysman both assume that the service fee pass-through rate is high (91.1% and 100%, respectively). However, empirical analysis of actual market data demonstrates that the service fee pass-through rate is only at most 3% in the aggregate, much lower than they have assumed. Dr. Singer makes an unsupported assumption about Google Play's but-for share, relying on a supposed benchmark that has little in common economically with mobile app stores. Dr. Rysman makes the unsupported assumption that apps are symmetric (i.e., the same) in terms of their quality, demand, costs, and price. His calculation would be substantially different if he accounted for the asymmetries among apps that are present in the real world.

254. Mr. Solomon's disgorgement and restitution calculations rely on inputs sourced from Dr. Singer's and Dr. Rysman's. Because the latter calculations are flawed, so are the former. In addition, from an economics point of view, a disgorgement calculation should apportion the claimed "ill-gotten gains" to the particular plaintiff in question. Mr. Solomon did not perform any apportionment to the Plaintiffs.

255. Dr. Schwartz's calculations of the Match Plaintiffs' damages are flawed because he makes unsupported assumptions about Google's fee structure in the but-for world. He leaves unexplained how this claimed but-for fee structure would work for other app developers and whether it would be Google's optimal choice of fee structure. In addition, Dr. Schwartz bases his estimate of Match's but-for payments on an internal Google analysis of the potential value of those services, but fails to account for the fact that the analysis did not fully value all aspects of Play and went through a number of iterations over time. Indeed, Dr. Schwartz based his calculations on only one of the iterations—the one that yielded the lowest value of Play to the Match Plaintiffs. Had Dr. Schwartz used any of the other iterations, his calculated damages would have been much lower than he estimated, or even negative. Finally, Dr. Schwartz ignores that Match would have still owed fees for app discovery and delivery for Match apps that did not use Google Play's billing system. Accounting for the fees on these transactions would result in a substantial offset to Dr. Schwartz's calculated damages.

256. I performed two alternative consumer damages calculations. In the first calculation , I use Google's current (2022) service fee structure as an estimate of its but-for world service fee structure. Under this approach, I calculate consumer damages for the period from August 16, 2016 to May 31, 2022 to be up to [redacted] In the second calculation, I use Google's level of consumer subsidies after the Play Points program was introduced in the U.S. as an estimate of its

but-for world consumer subsidies. Under this approach, I calculate consumer damages for the period from August 16, 2016 to May 31, 2022 to be up to [redacted] related to Play Points and up to [redacted] based on other types of consumer discounts.

257. From an economics point of view, "restitution" should be the same as consumer damages.

258. Finally, I have calculated Match Plaintiffs' damages under the assumption that the 2022 Google Play service fees would have been in effect from the beginning of the Match Plaintiffs' damages period. Using this approach, the Match Plaintiffs are calculated to have paid [redacted] more in service fees for the period from 7/7/2017 – 12/31/2021 and [redacted] for the period from 5/9/2018 – 12/31/2021 than they would have paid in the but-for world. However, I also find that Google would have charged a service fee for Match Plaintiffs' transactions that were not processed through Google Play's billing system and Match would have to pay these service fees to Google in the but-for world. After accounting for this offset, damages for both periods are negative (i.e., Match Plaintiffs' would owe more to Google than the alleged excess services fees it paid to Google). Thus, Match Plaintiffs are not entitled to any damages.

Gregory K. Leonard

Dated: November 18, 2022

Appendix A. Resume

Gregory K. Leonard
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PhD, Economics
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Dr. Gregory K. Leonard is a vice president in the Antitrust & Competition Economics Practice of CRA. He specializes in applied microeconomics and econometrics. He has provided testimony before US federal and state courts, government agencies, and arbitration panels on issues involving antitrust, damages estimation, statistics and econometrics, surveys, valuation, and labor market discrimination.

Dr. Leonard has written extensively in the areas of antitrust, industrial organization, econometrics, intellectual property, class certification, and labor economics. His publications have appeared in journals such as the *RAND Journal of Economics*, the *Journal of Industrial Economics*, the *Journal of Econometrics*, the *International Journal of Industrial Organization*, and the *Antitrust Law Journal*, among others. Dr. Leonard's writings were cited by the Court of Appeals for the Federal Circuit in its *Uniloc* decision. He is the Editorial Board Vice Chair for Economics of the *Antitrust Law Journal* and has served as a referee for numerous economic journals.

Dr. Leonard has given invited presentations on antitrust and intellectual property issues at the (US) Federal Trade Commission, the US Department of Justice, the former Anti-Monopoly Bureau of China's Ministry of Commerce, the Supreme People's Court of China, and Japan's Fair Trade Commission. He served as a consultant on the issue of immunities and exemptions to the (US) Antitrust Modernization Commission.

Papers and publications

"A Proposed Method for Measuring Competition Among Imperfect Substitutes." With J. Hausman and D. Zona. *Antitrust Law Journal* 60, 1992, pp. 889-900.

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"A Comparison of the Almost Ideal Demand System and Random Coefficients Logit Models For Use with Retail Scanner Data." With F. Deng. Working Paper, 2007.

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"Assessing Use Value Losses Due to Natural Resource Injury," paper presented at "Contingent Valuation: A Critical Assessment," Cambridge Economics Symposium, April 3, 1992 (with J. Hausman and D. McFadden).

"Contingent Valuation and the Value of Marketed Commodities," paper submitted to the Contingent Valuation Panel of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, August 12, 1992 (with J. Hausman).

"Economic Analysis of Differentiated Products Mergers Using Real World Data," paper presented to the George Mason University Law Review Antitrust Symposium, October 11, 1996 (with J. Hausman).

"Documents Versus Econometrics in Staples," paper presented to a program of the Economics Committee of the ABA Antitrust Section, September 5, 1997 (with J. Hausman).

Discussant, "New Developments in Antitrust" session, AEA meetings, January 7, 2000.

"In Defense of Merger Simulation," Department of Justice and Federal Trade Commission Merger Workshop, Unilateral Effects Session, February 18, 2004.

Discussant, "Proving Damages in Difficult Cases: Mock Trial & Discussion," NERA Antitrust & Trade Regulation Seminar, July 10, 2004.

"Network Effects, First Mover Advantage, and Merger Simulation in Damages Estimation," LSI Workshop on Calculating and Proving Patent Damages, July 16, 2004.

"Early Exchange of Documents," LSI Workshop on Pre- and Early Stage Patent Litigation, July 23, 2004.

"Lessons Learned From Problems With Expert Testimony: Antitrust Suits," LSI Workshop on Effective Financial Expert Testimony, November 4, 2004.

"Price Erosion and Convoyed Sales," LSI Workshop on Calculating & Proving Patent Damages, January 19, 2005.

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"Issues to Consider in a Lost Profits Damages Analysis," Patent Litigation 2005, Practicing Law Institute, September 30, 2005.

"Antitrust Issues in Standard Setting and Patent Pools," Advanced Software Law and Practice Conference, November 3, 2005.

"New Technologies for Calculating Lost Profits," LSI Workshop on Calculating & Proving Patent Damages, February 27, 2006.

"Estimating Antitrust Damages," Fair Trade Commission of Japan, April 21, 2006.

"Economic Analysis of Rule 23(b)(3)," LSI Litigating Class Action Suits Conference, May 11, 2006.

"Permanent Injunction or Damages: What is the Right Remedy for Non-Producing Entities?," San Francisco Intellectual Property Law Association/Los Angeles Intellectual Property Law Association Spring Seminar, May 20, 2006.

"Antitrust Enforcement in the United States" and "Economic Analysis of Mergers," Sino-American Symposium on the Legislation and Practice of Anti-Trust Law, Beijing Bar Association, Beijing, People's Republic of China, July 17, 2006.

"Economic Analysis in Antitrust," Chinese Academy of Social Sciences, Beijing, People's Republic of China, July 20, 2006.

"Issues to Consider in a Lost Profits Damages Analysis," Patent Litigation 2006, Practicing Law Institute, September 26, 2006.

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Discussant, "Applied Economics" Session, Pacific Rim Conference, Western Economic Association, Beijing, People's Republic of China, January 12, 2007.

"Balancing IPR Protection and Economic Growth in China," International Conference on Globalization and the Protection of Intellectual Property Rights, Chinese University of Political Science and Law, Beijing, People's Republic of China, January 20, 2007.

"The Use and Abuse of Daubert Motions on Damages Experts: Lessons from Recent Cases," LSI Workshop on Calculating & Proving Patent Damages, February 27, 2007.

"Will Your Licenses Ever be the Same? Biotechnology IP Strategies," BayBio 2007 Conference, April 26, 2007.

"Tension Between Antitrust Law and IP Rights," Seminar on WTO Rules and China's Antimonopoly Legislation, Beijing, People's Republic of China, September 1, 2007.

"Issues to Consider in a Lost Profits Damages Analysis," Patent Litigation 2007, Practicing Law Institute, September 25, 2007.

Discussant, "Dominance and Abuse of Monopoly Power" Session, China's Competition Policy and Anti-Monopoly Law, J. Mirrlees Institute of Economic Policy Research, Beijing University, and the Research Center for Regulation and Competition, Chinese Academy of Social Sciences, Beijing, People's Republic of China, October 14, 2007.

"Opening Remarks," Seminar on China's Anti-monopoly Law and Regulation on Abuse of Intellectual Property Rights, Beijing, People's Republic of China, April 26, 2008.

"Issues to Consider in a Reasonable Royalty Damages Analysis," Patent Litigation 2008, Practicing Law Institute, October 7, 2008.

"Econometric Evaluation of Competition in Local Retail Markets," Federal Trade Commission and National Association of Attorneys General Retail Mergers Workshop, December 2, 2008,

"Merger Review Best Practices: Competitive Effects Analysis," International Seminar on Anti-Monopoly Law: Procedure and Substantive Assessment in Merger Control, Beijing, People's Republic of China, December 15-17, 2008.

"The Use of Natural Experiments in Antitrust," Renmin University, Beijing, People's Republic of China, December 18, 2008.

"China's Antimonopoly Law: An Economist's Perspective," Bloomberg Anti-Monopoly Law of China Seminar, January 29, 2009.

Panelist, "Standards for Assessing Patent Damages and Their Implementation by Courts," FTC Hearings on the Evolving IP Marketplace, February 11, 2009.

"Economic Analysis of Agreements Between Competitors" and "Case Study: FTC Investigates Staples' Proposed Acquisition of Office Depot," Presentation to Delegation of Antitrust Officials from the People's Republic of China, Washington, DC, March 23, 2009.

"Reasonable Royalties in the Presence of Standards and Patent Pools," LSI Workshop, April 20, 2009.

Presentations on Unilateral Effects, Buyer Power, and the Intellectual Property-Antitrust Interface to Delegation from the Anti-Monopoly Bureau of MOFCOM of the People's Republic of China, Washington, DC, May 10-11, 2009.

Panelist, "The Use of Economic and Statistical Models in Civil and Criminal Litigation," Federal Bar Association, San Francisco, May 13, 2009.

"Trends in IP Rights Litigation and Economic Damages in China," Pursuing IP in the Pacific Rim, May 14, 2009.

Presentation on the Economics of Antitrust, National Judicial College of the People's Republic of China, Xi'an, People's Republic of China, May 25-26, 2009.

"Case Study: The Use of Economic Analysis in Merger Review," Presentation to the Anti-Monopoly Bureau of MOFCOM, Beijing, People's Republic of China, May 27, 2009.

"Economics and Antitrust Law," China University of Political Science and Law, Beijing, People's Republic of China, September 21, 2009.

"Case Study: Economic Analysis of Coordinated Interaction," Presentation to the Anti-Monopoly Bureau of MOFCOM, Beijing, People's Republic of China, September 22, 2009.

"Relevant Market Definition," 4th Duxes Antitrust Law Seminar, Beijing, People's Republic of China, September 26, 2009.

"Expert Economic Testimony in Antitrust Litigation," Supreme People's Court, Beijing, People's Republic of China, February 2, 2010.

"New Case Law for Patent Damages," Law Seminars International Telebriefing, April 28, 2010.

"China/India: Sailing in Unchartered Waters: Regulating Competition in the Emerging Economies – New Laws, New Enforcement Regimes and No Precedents," The Chicago Forum on International Antitrust Issues, Northwestern University School of Law Searle Center, May 20, 2010.

"Antitrust and Intellectual Property," Supreme People's Court, Beijing, People's Republic of China, May 26, 2010.

"Cartel Enforcement Trends in the United States," 2nd Ethical Beacon Anti-Monopoly Summit, Beijing, People's Republic of China, May 27, 2010.

Panelist, "The Future of Books and Digital Publishing: the Google Book Settlement and Beyond," 2010 American Bar Association Annual Meeting, August 7, 2010.

"Coordinated Effects" and "Non-Horizontal Mergers," Presentations to Delegation from India Competition Commission, US Chamber of Commerce, Washington, DC, October 26, 2010.

"UPP and Merger Simulation," Annual Conference of the Association of Competition Economics, Norwich, UK, November 11, 2010.

"Uniloc v. Microsoft: A Key Ruling For Patent Damages," Law Seminars International Telebriefing, January 21, 2011.

"Correlation, Regression, and Common Proof of Impact," New York City Bar Association, January 19, 2011.

"Private Litigation Under China's New Antimonopoly Law," Bar Association of San Francisco, February 17, 2011.

"Competition Law and State Regulation: Setting the Stage and Focus on State-Owned Enterprises," Competition Law and the State: International and Comparative Perspectives, Hong Kong, People's Republic of China, March 18, 2011.

Panelist, "Booking it in Cyberspace: The Google Book Settlement and the Aftermath," American Intellectual Property Law Association, San Francisco, May 13, 2011.

"Econometric Estimation of Cartel Overcharges," ZEW Conference on Economic Methods and Tools in Competition Law Enforcement, Mannheim, Germany, June 25, 2011.

Panelist, "Antitrust and IP in China," Antitrust and IP in Silicon Valley and Beyond, American Bar Association and Stanford University, Palo Alto, October 6, 2011.

Panelist, University of San Diego School of Law Patent Law Conference: The Future of Patent Law Remedies, January 18, 2013.

"Economics Framework," US-China Workshop on Competition Law and Policy for Internet Activities, China's State Administration for Industry and Commerce (SAIC) and the U.S. Trade and Development Agency (USTDA), Shenzhen, People's Republic of China, June 4-5, 2013.

Panelist, "China Inside and Out," American Bar Association, Beijing, People's Republic of China, September 16-17, 2013.

Panelist, "Remedies in Patent Cases," Fifth Annual Conference on The Role of the Courts in Patent Law & Policy, Berkeley and Georgetown Law Schools, November 1, 2013.

"Royalty Base," LeadershIP Conference, Qualcomm Incorporated, March 21, 2014.

"Reflections on Natural Experiments," DG Comp, April 8, 2014.

Panelist, "Antitrust in Asia: China," American Bar Association Section of Antitrust Law, Beijing, People's Republic of China, May 21-23, 2014.

Panelist, "Patent Damages Roundtable," 2015 Intellectual Property Institute, University of Southern California Gould School of Law, Los Angeles, March 23, 2015.

Panelist, "IP and Antitrust – The Current State of Economic Analysis," Global Competition Review Live 2nd Annual IP & Antitrust USA, Washington, DC, April 14, 2015.

Panelist, "FRAND Royalty Rates After Ericsson v. D-Link," American Bar Association, May 15, 2015.

Participant, Patent Damages Workshop, University of California-Berkeley, March 3, 2016.

Panelist, "FRANDtopia – In a Perfect World," LAIPLA Spring Conference, May 5, 2018.

Panelist, "Chicago Forum on International Antitrust Issues," Northwestern Pritzker School of Law, June 15, 2018.

Panelist, "Competition in Digital Advertising: Is There Online and Offline Convergence?," Challenges to Antitrust in a Changing Economy, Harvard Law School, November 8, 2019.

Testimonies given in the last four years

Boston Scientific Corporation and Boston Scientific Scimed, Inc. v. Edwards Lifesciences Corporation; *Edwards Lifesciences Corporation, Edwards Lifesciences PVT, Inc. and Edwards Lifesciences LLC v. Boston Scientific Corporation, Boston Scientific Scimed, Inc., and Sadra Medical, Inc.*, United States District Court for the District of Delaware, Case No. 16-CV-275 (SLR), 2017 (Deposition), 2018 (Trial Testimony).

Depomed, Inc. v. Purdue Pharma L.P., The P.F. Laboratories, Inc., and Purdue Pharmaceuticals L.P., United States District Court for the District of New Jersey, Civil Action No. 3:13-00571 (BRM/TJB), 2018 (Deposition).

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Huawei Technologies, Co., Ltd. et al. v. Samsung Electronics Co. Ltd., et al., United States District Court for the Northern District of California, San Francisco Division, Case No. 16-CV-02787-WHO, 2018 (Deposition).

Asustek Computer Incorporated, et al. v. InterDigital, Inc., et al., United States District Court for the Northern District of California, San Jose Division, Case No. 15-CV-1716 BLF, 2018 (Deposition).

Amgen Inc. v. Coherus Biosciences Inc., Superior Court of the State of California, County of Ventura, Case No. 56-2017-00493553-CU-VT-VTA, 2018 (Deposition).

Plexxikon Inc. v. Novartis Pharmaceuticals Corporation, United States District Court for the Northern District of California, Case No. 4:17-CV-04405-HSG (EDL), 2019 (Deposition), Trial Testimony (2021).

Press Ganey Associates, Inc. v. Qualtrics, LLC, American Arbitration Association, Case No. 01-18-0004-4674, 2019 (Deposition).

In the Matter of: Determination of Rates and Terms for Digital Performance of Sound Recordings and Making of Ephemeral Copies to Facilitate those Performances (Web V), before the United States Copyright Royalty Board Library of Congress, Docket No. 19-CRB-0005-WR (2021-2025), 2020 (Deposition, Trial Testimony).

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3Shape A/S v. Align Technology, Inc., United States District Court for the District of Delaware, Civil Action No. 18-886-LPS-CJB, 2020 (Deposition).

District Council #16 Northern California Health & Welfare Trust Fund v. Sutter Health, et al, No. RG15753647, 2021 (Deposition).

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American Society of Composers, Authors and Publishers v. Radio Music License Committee, Arbitration, 2021 (Hearing Testimony).

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In Re Caustic Soda Antirust Litigation, United States District Court for the Western District of New York, Case No. 1:19-cv-003895-EAW-MJR, 2022 (Deposition).

Bedford, Freeman & Worth Publishing Group, LLC d/b/a Macmillan Learning, Macmillan Holdings, LLC, Cengage Learning, LLC, Elsevier Inc., Elsevier B.V., McGraw Hill LLC, and Pearson Education Inc. v. Shopify, Inc, United States District Court for the Eastern District of Virginia, Case 1:21-cv-01340, 2022 (Deposition).

Professional activities

Member, American Economic Association

Member, Econometric Society

Member, American Bar Association

Contributor, www.antitrust.org

Contributor, ABA Section of Antitrust Law, *Econometrics*, 2005

Associate Editor, *Antitrust*, 2007-2010

Senior Editor, *Antitrust Law Journal*, 2012-; Associate Editor, 2010-2012

Co-Editor, ABA Section of Antitrust Law Economics Committee Newsletter, 2009-2012

Member, Economics Task Force, ABA Section of Antitrust Law, 2011-2012

Member, ABA Delegation to International Seminar on Anti-Monopoly Law: Procedure and Substantive Assessment in Merger Control, Beijing, People's Republic of China, December 15-17, 2008.

Member, Working Group for drafting the "Joint Comments of the American Bar Association Section of Antitrust Law and Section of International Law on the MOFCOM Draft Guidelines for Definition of Relevant Markets," 2009.

Member, Working Group for drafting the "Joint Comments of the American Bar Association Section of Antitrust Law and Section of International Law on the SAIC Draft Regulations on the Prohibition of Acts of Monopoly Agreements and of Abuse of Dominant Market Position," 2009.

Member, Working Group for drafting the "Joint Comments of the American Bar Association Section of Antitrust Law and Section of International Law on the SAIC Draft Regulations on the Prohibition of Acts of Monopoly Agreements and of Abuse of Dominant Market Position," 2010.

Referee: *Econometrica*, *Review of Economics and Statistics*, *International Journal of Industrial Organization*, *Review of Industrial Organization, Journal of Sports Economics*, *Journal of Environmental Economics and Management*, *Research in Law and Economics*, *Labour Economics*, *Eastern Economic Journal*, *Journal of Forensic Economics, Antitrust, Antitrust Law Journal, Journal of Competition Law and Economics, Advances in Econometrics.*

Professional history

12/2019–Present	*Vice President*, Charles River Associates
2012–2019	*Partner*, Edgeworth Economics
2008–2012	*Senior Vice President*, NERA Economic Consulting
2004–2008	*Vice President*, NERA Economic Consulting
2000–2004	*Senior Vice President*, Lexecon, Inc.
1991–2000	*Director*, Cambridge Economics, Inc.
1990–1991	*Senior Analyst*, NERA Economic Consulting
1989–1990	*Assistant Professor*, Columbia University

- Econometrics
- Statistics
- Labor Economics

Appendix B
Documents Relied Upon

Report and Exhibits

Bates Documents

AMZ-GP_00001629	EPIC_GOOGLE_03979041	GOOG-APPL-00044136	GOOG-PLAY-000272539
GOOG-PLAY-000337564	GOOG-PLAY-000542516	GOOG-PLAY-000542516.R	GOOG-PLAY-000565541
GOOG-PLAY-000565541.R	GOOG-PLAY-000604733	GOOG-PLAY-001291192	GOOG-PLAY-001507601
GOOG-PLAY-003331764	GOOG-PLAY-003335786.R	GOOG-PLAY-004625919	GOOG-PLAY-00518034
GOOG-PLAY-005535886	GOOG-PLAY-007203251	GOOG-PLAY-007328838	GOOG-PLAY-007346079
GOOG-PLAY-007346097	GOOG-PLAY-007355763	GOOG-PLAY-011023692	GOOG-PLAY-011271382
GOOG-PLAY-01127244	GOOG-PLAY-011274244	GOOG-PLAY3-000018260	MATCHGOOGLE00105742
MATCHGOOGLE00105770	MATCHGOOGLE00105797	MATCHGOOGLE00105815	MATCHGOOGLE00106377
MATCHGOOGLE00106378	MATCHGOOGLE00106379	MATCHGOOGLE00106380	MATCHGOOGLE00115561
MATCHGOOGLE00115566	MATCHGOOGLE00119761	SEA_GOOGLE_00000720	

Depositions

Deposition and Exhibits of Adrian Ong, October 14, 2022
Deposition and Exhibits of Daniel Scalise, March 11, 2022.
Deposition and Exhibits of Donn Morrill, August 11, 2022.
Deposition and Exhibits of Lacey Ellis, March 22, 2022.
Deposition and Exhibits of Michael Marchak, January 12-13, 2022.
Deposition and Exhibits of Paul Feng, January 14 and 18, 2022.
Deposition and Exhibits of Richard Czeslawski, June 17, 2021.
Deposition and Exhibits of Sarah Karam, September 28, 2022.
Deposition and Exhibits of Sharmistha Dubey, October 13, 2022.

Expert Reports

Class Certification Reply Report of Dr. Hal J. Singer, April 15, 2022.
Class Certification Report of Dr. Hal J. Singer, February 28, 2022.
Expert Report of Douglas Skinner, March, 31, 2022.
Expert Report of Dr. Marc Rysman, October 3, 2022.
Expert Report of Dr. Michelle Burtis, March 31, 2022.
Expert Report of Dr. Steven Schwartz, October 3, 2022.
Expert Report of Saul Solomon, October 3, 2022.
Merits Report of Dr. Hal J. Singer, October 19, 2022.
Merits Report of Dr. Marc Rysman, October 3, 2022.

Case Documents

Declaration of Peter Foster In Support of Plaintiffs' Motion for Temporary Restraining Order, May 10, 2022.
Email from B. Rocca (Morgan Lewis), "B. Rocca Letter to G. Arenson re Transactional Data," October 11, 2021.
Email from B. Rocca (Morgan Lewis), "B. Rocca Letter to Plaintiffs re Transactional Data," January 14, 2022.
Email from B. Rocca (Morgan Lewis), "B. Rocca Letter to Plaintiffs re Transactional Data," August 23, 2022.

Other

App Annie Data Produced in Response to Consumers' June 2, 2021 Subpoena.
Discussion with Krishna Shrinivas, Head of Research and Insights, Android and Play Strategy, November 14, 2022.
"Rovio: Extensive Report," inderes, September 6, 2022, pp. 8-18.
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Borck Jonathan, Juliette Caminade, and Markus von Wartburg, "Apple's App Store and Other Digital Marketplaces," Analysis Group, July 22, 2020.

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Federal Communications Commission, "Reference Book of Rates, Price Indices, and Expenditures for Telephone Service," June 1999.

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"Chapter 3. Time Value of Money" in Smart, Scott B., William L. Megginson, and Lawrence J. Gitman, *Corporate Finance* , 2nd Edition, Thomson, 2007.

Abadie, Alberto, "Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects," Journal of Economic Literature, Vol. 59, No. 2, 2021, pp. 391–425.

Al-Subaihin, Afnan A. et al., "Clustering Mobile Apps Based on Mined Textual Features," Proceedings of the 10th ACM/IEEE International Symposium on Empirical Software Engineering and Measurement, 2016, pp. 1-10.

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Bajaj, Mukesh, David J. Denis, Stephen P.Ferris, and Atulya Sarin, "Firm Value and Marketability Discounts," *Journal of Corporation Law* , Vol. 27, No. 1, 2001, pp. 89-115.

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Screenshots of Tinder Mobile App Downloaded from Google Play as of November 16, 2022.

APPENDIX C

PASS-THROUGH ESTIMATION

A. Estimation Approach

a. Paid Downloads and IAPs

1. Starting from July 1, 2021, Google lowered the service fee rate for a developer's first $1 million annual global revenue from 30% to 15%, provided that the developer enrolls in the program. This change reduced the service fee rate for IAPs and paid downloads by a uniform 15 percentage points for the group of developers who enroll in the program and have annual revenue below the $1 million cap. A second group of developers who do not enroll in the program or have annual revenue that far exceeds the $1 million cap continue to pay a 30% or close to 30% service fee on their paid downloads and IAPs.[1] As discussed in the report, I use the former group as the "treated" group and the latter as the "control" group. I quantify the extent of pass-through by comparing the price changes *before and after* Google's service fee rate change *between* these two groups of developers.

2. The control group serves as a benchmark for the treated group. Because the control group contains a number of different control units which may be of varying usefulness as controls for the treated units, I use the Synthetic Control Method (SCM, hereafter). This method involves constructing a "synthetic" control by taking a convex combination of the control units so as to maximize the similarity of the synthetic control to the (average) treated unit in the period

[1] On July 1, 2021, Google reduced the service fee rate from 30% to 15% to each developer's first $1 million consumer spend made in each calendar year (with the partial year cap of $0.5 million for 2021). The service fee rate will return to 30% once the $1 million annual cap is reached. Developers need to complete enrollment to receive the service fee rate reduction. See "Changes to Google Play's service fee in 2021," Play Console Help, https://support.google.com/googleplay/android-developer/answer/10632485. For developers whose annual revenue far exceeds $1 million, the monthly average service fee rate stay close to 30% even if they enroll.

prior to the service fee rate change.[2] SCM has become widely used in empirical economics research and is described by the 2022 Nobel Laureate in Economics Guido Imbens as “arguably the most important innovation in the policy evaluation literature in the last 15 years.”[3]

3. I use an extension of the original SCM approach designed for situations with a large number of treated and control units as is the case here.[4] The method gives an estimate of the percentage difference between the prices before and after the service rate change for the “treated” group that is caused by the service rate change. I then convert this estimate into the pass-through rate. Specifically, let α denote the difference in the logarithm of the actual price of the treatment group (p_o) and the counterfactual price of the treatment group (p_c), i.e., $\alpha = \log\left(\frac{p_o}{p_c}\right)$, and let r_c and r_o be the Google’s service fee on the treated units before and after the intervention. Let $\widehat{\alpha}$ be an estimate of α using SCM and let $\widehat{\sigma}$ be the standard error in the estimation. Then a commonly used estimate for the relative price change ($p_o/p_c - 1$) is $\widehat{\beta} = e^{\widehat{\alpha}-\frac{\widehat{\sigma}^2}{2}} - 1$. Consequently, I estimate the pass-through rate as

$$\widehat{PT} = \frac{p_o - p_c}{r_o p_o - r_c p_c} = -\frac{p_o/p_c - 1}{(r_c - r_o) - r_o(p_o/p_c - 1)} = -\frac{\widehat{\beta}}{r_c - r_o - r_o\widehat{\beta}}$$

b. Subscriptions

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2 Abadie, Alberto, and Javier Gardeazabal, “The Economic Costs of Conflict: A Case Study of the Basque Country,” American Economic Review (2003) 93 (1): 113–32; Abadie, Alberto, Alexis Diamond, and Jens Hainmueller, “Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California’s Tobacco Control Program,” Journal of the American Statistical Association (2010) 105 (490): 493–505.

3 Athey, Susan, and Guido W. Imbens. 2017. “The State of Applied Econometrics: Causality and Policy Evaluation.” Journal of Economic Perspectives 31 (2): 3–32.

4 Michael W. Robbins, Jessica Saunders & Beau Kilmer, “A Framework for Synthetic Control Methods With High-Dimensional, Micro-Level Data: Evaluating a Neighborhood-Specific Crime Intervention,” Journal of the American Statistical Association (2017) 112 (517): 109-126.

4. The July 1, 2021 service fee reduction also applies to a developer's first $1 million annual global revenue from subscriptions, provided that the developer enrolls in the program. This change reduces the service fee rate of subscriptions by up to 15 percentage points for the group of developers who enroll in the program and have gross annual revenue below the $1 million cap.[5] Another service fee rate reduction for subscriptions began on January 1, 2022 and reduces the service fee rate for all subscription products to a flat 15%.[6] This group of subscription products, i.e., those that paid more than 15% before July 1, 2021 and started paying a lower rate of 15% after July 1, 2021 provided that their developers enrolled in the program, are used as the treatment units. Since the January 1, 2022 rate reduction applies to all subscription products, I use the subscription products that have been subject to a 15% service fee rate throughout the study periods as the control group. These subscription products were subject to a 15% service fee rate during the pre-period because they were either in a developer deal program (e.g., LRAP, ADAP, SwG) or their sales during the pre-period mostly (or entirely) consist of sales to users who have been subscribers longer than 12 months (and therefore were subject to 15% since the January 1, 2018 subscription rate change).[7] I quantify the extent of pass-through for subscriptions by comparing the price changes *before and after* Google's service fee rate change *between* the subscription products of

5 Subscriptions may be subject to a blended rate of 15% and 30% before July 1, 2021, as the January 1, 2018 service fee rate change reduced the service fee rate for subscription sales from subscribers lasting more than 12 months. "Google Play Lowers App Subscription Fee to 15 Percent, Matches Apple's Offering," Gadgets 360, October 20, 2017, https://gadgets.ndtv.com/apps/news/google-play-app-subscription-fee-30-percent-to-15-1764923.

6 "Evolving Our Business Model to Address Developer Needs," Android Developers Blog, October 21, 2021, https://android-developers.googleblog.com/2021/10/evolving-business-model.html.

7 Google's Living Room Accelerator Program ("LRAP") was introduced in 2016 for developers of subscription video apps. The Subscribe with Google ("SwG") program reduced the service fee rate for news app developers to 15%. The Audio Distribution Accelerator Program ("ADAP") offers audio and music app developers a service fee rate of 15%. See GOOG-PLAY-001291192; GOOG-PLAY-000604733; GOOG-PLAY-003335786.R; GOOG-PLAY-003331764.

these two groups of developers. I apply the same estimation approach as discussed above for subscription SKUs.

B. Data

5. In my econometric analysis of pass-through, I use Google Play transactions data for paid downloads, IAPs, and subscriptions.[8] The data include all the transactions from consumers whose legal country is the U.S. (hereafter "U.S. consumers") from March 5, 2009 to May 31, 2022. Each transaction record contains information on the purchase date, product type (paid download, IAP, or subscription), list price, net consumer spend, purchase quantity, discounts, Google revenue, and developer payout at the SKU level (as identified by the product ID field).[9] I construct and aggregate the following fields to the SKU-month level.[10]

- Price net of developer discount: This is calculated for each month and SKU by summing (within a SKU and month) the total net consumer spend and total Google discounts, and then dividing the result by the total sales quantity.[11] This captures the price that is net of discounts provided by the developer.
- Service fee rate: This is calculated for each month and SKU as the total Google revenue divided by the total gross consumer spend.[12, 13] Based on service fee rates

8 GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

9 For paid downloads, each paid app is a unique SKU. For IAPs and subscriptions, each IAP or subscription item is a unique SKU.

10 Testing transactions, transactions in non-USD currencies, and transactions with missing or zero list prices are excluded from the analysis. Month-SKU level observations with zero net price are also excluded. Month-SKU level observations with service fee rates being zero or equal to or greater than 30.5% are excluded from the analysis. The excluded month-SKU level observations account for only a negligible fraction of the full sample of month-SKU level observations.

11 The amount of discounts offered by Google is computed as the "promotion" amount from Google to consumers (when Google directly provides discounts to consumers) or the "promotion" amount from Google to developers (when Google co-funds discounts with developers). I use the pre-tax amounts for both the net price and the discounts.

12 Google's revenue is the service fee amount. I use the pre-tax amounts for both the service fees and the consumer spend.

13 Pre-tax gross consumer spend is used to calculate service fee rates.

at the month-SKU level, prior to July 2021, almost all the month-SKU combinations (>99.9%) for both IAPs and paid downloads were subject to a service fee rate between 29.5% to 30.5% (henceforth, 30%). After the service fee rate reduction on July 1, 2021, [redacted] of the month-SKU combinations for IAPs and [redacted] of the month-SKU combinations for paid downloads were subject to a service fee rate between 14.5% and 15.5% (henceforth, 15%).[14]

6. For the econometric analysis, I use the period from July 2020 to May 2022 (hereafter the "sample period"), with the period prior to the July 1, 2021 rate reduction (hereafter the "pre-period") covering July 2020 to June 2021 and the period after the July 1, 2021 rate reduction (hereafter the "post-period") covering July 2021 to May 2022. I construct the estimation samples for paid downloads, IAPs, and subscriptions respectively by keeping treatment and control units with non-zero sales for all months in the sample period (the "main sample").[15]

7. As explained above, the treatment and control groups for paid downloads, IAPs, and subscriptions are defined as follows:

	Treatment Group	Control Group
IAPs	Monthly average service fee rate = 30% in the pre period, =15% in the post period	Monthly average service fee rate = 30% in the pre period, =30% in the post period
Paid Downloads	Monthly average service fee rate = 30% in the pre period, =15% in the post period	Monthly average service fee rate = 30% in the pre period, =30% in the post period
Subscriptions	Monthly average service fee rate >= 25% in the pre period, =15% in the post period	Monthly average service fee rate = 15% in the pre period, =15% in the post period

14 Developers paying service fee rates above 15% after the July 2021 service fee policy change could be due to (1) developers not being enrolled in the 15% service fee rate program or (2) the annual cap of $1M USD ($0.5M USD for 2021) was reached. If a developer enrolled in the middle of a month or the annual cap was reached in middle of a month, transactions of SKUs owned by the developer in that month would have been subject to a mixture of 15% and 30% service fee rates, which would yield a blended monthly average service fee rate between 15% and 30%.

15 The main sample captures 26%, 33%, and 32% of revenue for IAP, paid downloads, and subscriptions respectively.

C. Estimation Results

8. Table C.1 below displays the estimates of the pass-through rate for paid downloads, IAPs, and subscriptions. The estimates are indistinguishable from zero statistically, i.e., the null hypothesis that the service fee rate reduction has zero average effect on the post-rate change prices – and hence the pass-through rate – is not rejected.

Table C. 1 Estimates of Pass-Through Rate

	IAPs	Paid Downloads	Subscriptions
Pass-Through Rate	[redacted]		
Pass-Through Rate (Upper Bound)			
P-Value	0.22	0.94	0.818
Number of Treated SKUs	16,047	3,113	2,874
Number of Control SKUs	11,507	1,404	3,295
Number of SKU-Month Obs.	633,742	103,891	141,887
Total Consumer Spend (8/16/16-5/31/22)	[redacted]		
Weighted Average Pass-Through Rate		**3.0%**	

Source: Exhibit 5.

9. As discussed in my report, for various analyses that need an estimate of the service fee pass-through rate, I conservatively use the upper bounds of the 95th confidence intervals for the pass-through rates shown in Table C.1.[16] These upper bounds are [redacted] for IAPs, [redacted] for paid downloads, and [redacted] for subscriptions. Using the total consumer spend for each monetization type during the class period as weights, I calculate the weighted average pass-through rate across the three types of transactions to be 3%.

D. Sensitivity Analyses

a. Placebo Test

[16] The 95 percent confidence interval for the pass-through rates is calculated as $\left[-\frac{e^{\widehat{\alpha_R}}-1}{r_c-r_o\times e^{\widehat{\alpha_R}}}, -\frac{e^{\widehat{\alpha_L}}-1}{r_c-r_o\times e^{\widehat{\alpha_L}}}\right]$, where $[\widehat{\alpha_L}, \widehat{\alpha_R}]$ is the 95 percent confidence interval for the ATT estimate $\hat{\alpha}$.

10. I conduct a "placebo" test for paid downloads, IAPs, and subscriptions using the pre-period data. Specifically, I use the time period from July 2020 to June 2021, with the "artificial" pre-period from July 2020 to February 2021 and the "artificial" post-period from March 2021 to June 2021. The SKUs in the control group and the treatment group are kept same. A finding of an effect statistically indistinguishable from zero would provide support for the proposition that the methodology I use constructs the proper synthetic control. The results in Table C.2 show that in fact, the estimates are not statistically significantly different from zero.

Table C. 2 Placebo Test for Pass-Through Rate Estimation

	IAPs	Paid Downloads	Subscriptions
Pass-Through Rate	[redacted]		
P-Value	0.68	0.62	0.88
Number of Treated SKUs	16,047	3,113	2,874
Number of Control SKUs	11,507	1,404	3,295
Number of SKU-Month Obs.	330,648	54,204	74,028

Source: Exhibit C1.

b. Subsamples by Revenue

11. There are a large number of SKUs with low levels of revenue in the monthly transactions data. To test whether the estimation results are driven by these SKUs, I run the analysis on the subset of SKUs remaining after removing SKUs with low levels of revenue. Specifically, I remove SKUs in both the treatment and control groups that have cumulative monthly revenue during the sample period (June 2020 to May 2022) in the bottom one percentile. For paid downloads, the remaining SKUs account for 97% of the total number of treatment and control group SKUs in the main sample; for IAPs, the remaining SKUs account for 55% of the SKUs in the main sample. The results based on the subsample of SKUs with revenue in the top 99 percentile are similar to the results using the full sample, as shown in Table C.3.

Table C. 3 Pass-Through Rate Estimation based on Subsamples by Revenue

	IAPs	Paid Downloads
Pass-Through Rate	[redacted]	
P-Value	0.29	0.99
Number of Treated SKUs	7,270	3,042
Number of Control SKUs	8,031	1,345
Number of SKU-Month Obs.	351,923	100,901

Source: Exhibit C2.

c. Shorter Post-Treatment Period

12. I test the robustness of the results for paid downloads and IAPs by using a shorter treatment period from July 2021 to December 2021, to separate any potential confounding effect of the January 2022 subscription service fee rate reduction on the prices of paid downloads or IAPs. The results based on the shorter treatment period for paid downloads and IAPs are similar to the results based on using the full treatment period, as shown in Table C. 4.

Table C. 4 Pass-Through Rate Estimation based on A Shortened Treatment Period

	IAPs	Paid Downloads
Pass-Through Rate	[redacted]	
P-Value	0.56	0.94
Number of Treated SKUs	16,047	3,113
Number of Control SKUs	11,507	1,404
Number of SKU-Month Obs.	495,972	81,306

Source: Exhibit C3.

d. Subsamples Based on the Treatment Group SKUs Having Low Revenue Share of Their Respective Categories

13. I test whether there is empirical support for the claim that the negligible service fee pass-through I found was due to the SKUs in the control group lowering their prices to compete with SKUs in the treatment group that lowered their prices. I use a subset of the data based on SKUs in app categories where the treatment units make up only a relatively small percentage of the category's total consumer spend (<=10% for IAPs, and <=40% for paid downloads). The results

based on these subsamples are similar to the results using the full main sample, as shown in Table C.5 – the pass-through rate estimates are still small and not statistically significantly different from zero.

Table C. 5 Pass-Through Rate Estimation
Based on Subsamples with Low Treatment Group Revenue Share

	IAPs	Paid Downloads
Pass-Through Rate	[redacted]	
P-Value	0.58	0.99
Number of Treated SKUs	8,663	318
Number of Control SKUs	8,535	116
Number of SKU-Month Obs.	395,554	9,982

Source: Exhibit C4.

APPENDIX D

PASS-THROUGH RATE FORMULA UNDER THE LOGIT DEMAND MODEL

1. Dr. Singer defines the pass-through rate as the "ratio of the dollar change in a developer's profit-maximizing price resulting from a one-dollar change in marginal cost."[1] Dr. Singer's formula erroneously considers Google Play's service fee as per-unit cost, rather than *ad valorem* cost. Specifically, Dr. Singer's pass-through is calculated as $\frac{\partial P}{\partial T}$, where P is the app price set by an app developer and T is the per-unit cost that does not depend on the price P.

2. The correct way to set up app developers' profit-maximizing pricing from change in service fee rate is to ask the question "how the service fee *rate* change would affect the profit-maximizing price." That is, the correct calculation would be based on $\frac{\partial P}{\partial t}$, where P is the app price set by an app developer and t is the service fee rate. To make the formula more comparable to Singer's pass-through formula where both the numerator and denominators are changes in dollar amounts, the corrected formula to consider is $\frac{\partial P}{\partial t}\frac{1}{P}$.

3. Below I first show the correct pass-through rate formula under Dr. Singer's logit demand model. The correct formula makes it clear that the pass-through rate of the service fee rate depends on the per unit marginal cost, a critical insight that Dr. Singer ignores. I then formally show why Dr. Singer's formula is incorrect for the reason explained above.

A. Pass-Through Rate Formula Under the Logit Demand Curve

[1] Singer Report ¶ 360.

4. I show below the pass-through formula under the logit demand model that Dr. Signer chose to use, when correctly considering the service fee as an ad valorem cost (rather than a per-unit cost independent from app price change).

5. Under the *ad valorem* service rate, a developer's profit function is:

$$\pi = Q(P) \times (P - P \times t - C) = Q(P) \times (P(1-t) - C) \tag{A.1}$$

where Q is sales quantity, P is app price, t is service fee rate, and C is developer's non-service fee fixed per unit marginal cost. If the app developer maximizes profit by choosing app price as Dr. Singer assumes, the first order condition is:

$$\frac{\partial \pi}{\partial P} = \frac{\partial Q}{\partial P}(P(1-t) - C) + Q(1-t) = 0 \tag{A.2}$$

6. Under a logit demand model, any app developer j's market share $S_j = \frac{Q_j}{M}$ follows the below functional form, where M is the total sales quantity for all the app developers in the market, i.e., market size:

$$S_j = \frac{e^{(\delta_j + \alpha P_j)}}{\sum_i e^{(\delta_i + \alpha P_i)}}, S_0 = \frac{1}{\sum_i e^{(\delta_i + \alpha P_i)}} \tag{A.3}$$

$$\text{Hence } \frac{S_j}{S_0} = e^{(\delta_j + \alpha P_j)}, ln\left(\frac{S_j}{S_0}\right) = \delta_j + \alpha P_j$$

where α is the price sensitivity of the consumers in the logit demand function and S_0 is the market share of outside goods.[2] Hence, the demand curve slope $\frac{\partial Q_j}{\partial P_j}$ can be derived as:

$$\frac{\partial Q_j}{\partial P_j} = Q_j \frac{\partial ln(Q_j)}{\partial P_j} = Q_j \frac{\partial \left(ln(M) + ln\left(e^{(\delta_j + \alpha P_j)}\right) - ln\left(\sum_i e^{(\delta_i + \alpha P_i)}\right)\right)}{\partial P_j}$$

2 Also see Singer Report, ¶348.

$$\frac{\partial Q_j}{\partial P_j} = Q_j\left(\alpha - \frac{\partial ln\left(\sum_i e^{(\delta_i+\alpha P_i)}\right)}{\partial P_j}\right) = Q_j\left(\alpha - \frac{1}{\sum_i e^{(\delta_i+\alpha P_i)}}\frac{\partial e^{\left(\delta_j+\alpha P_j\right)}}{\partial P_j}\right)$$

$$\frac{\partial Q_j}{\partial P_j} = Q_j\left(\alpha - \frac{\alpha e^{\left(\delta_j+\alpha P_j\right)}}{\sum_i e^{(\delta_i+\alpha P_i)}}\right) = Q_j\left(\alpha - \alpha S_j\right) = \alpha Q_j\left(1 - S_j\right) \tag{A.4}$$

and

$$\frac{\partial S_j}{\partial P_j} = \frac{1}{M}\frac{\partial Q_j}{\partial P_j} = \alpha S_j\left(1 - S_j\right) \tag{A.5}$$

Substituting equation (A.4) into equation (A.2), the profit maximization condition becomes:

$$\alpha(1-S)(P(1-t)-C) + (1-t) = 0$$

$$\alpha(1-S)\left(P - \frac{C}{1-t}\right) + 1 = 0 \tag{A.6}$$

Taking derivative with respect to t on both sides of equation (A.6):

$$\alpha(1-S)\left(\frac{\partial P}{\partial t} - \frac{C}{(1-t)^2}\right) - \alpha\left(\frac{\partial S}{\partial P}\frac{\partial P}{\partial t}\right)\left(P - \frac{C}{1-t}\right) = 0 \tag{A.7}$$

Combining equations (A.5) and (A.7) gives the corrected pass-through rate formula:

$$\frac{\partial P}{\partial t} = (1-S)\frac{C}{(1-t)^2} = \frac{M-Q}{M} \times \frac{C}{(1-t)^2} \tag{A.8}$$

and

$$\frac{\Delta P}{(t+\Delta t)(P+\Delta P) - tP} \approx \frac{\partial P}{\partial t}\frac{1}{P} = (1-S)\frac{C/P}{(1-t)^2} = \frac{M-Q}{M} \times \frac{C}{P(1-t)^2} \tag{A.9}$$

7. Note that the per unit marginal cost C appears in this correct pass-through rate formula. Consequently, the pass-through rate of the service fee rate tends toward zero as app developers' non-service fee marginal cost amount (C) tends toward zero.

B. Dr. Singer's Incorrect Pass-Through Rate Formula

8. Dr. Singer, instead, defines an app developer's profit is defined as:

$$\pi = Q(P) \times (P - T - C) \tag{A.10}$$

where T is an additional fixed per-unit cost (analogous to the service fee-based cost $P \times t$), which critically does not depend on the price P. This is the crucial difference between (A.1) and (A.10). Under this wrong characterization of the service fee, the first order condition becomes:

$$\frac{\partial \pi}{\partial P} = \frac{\partial Q}{\partial P}(P - T - C) + Q = 0 \tag{A.11}$$

Substituting equation (A.4) into equation (A.11), the profit maximization condition becomes:

$$\alpha(1 - S)(P - T - C) + 1 = 0 \tag{A.12}$$

Taking derivative with respect to T on both sides of equation (A.12):

$$\alpha(1 - S)\left(\frac{\partial \mathrm{P}}{\partial \mathrm{T}} - 1\right) + \alpha\left(-\frac{\partial S}{\partial P}\frac{\partial P}{\partial T}\right)(P - T - C) = 0 \tag{A.13}$$

Substituting equation (A.12) into equation (A.13) leads to

$$(1 - S)\left(\frac{\partial P}{\partial T} - 1\right) - \alpha S(1 - S)(P - T - C)\left(\frac{\partial P}{\partial T}\right) = 0 \tag{A.14}$$

Combining equations (A.5) and (A.14) leads to Dr. Singer's pass-through rate formula[3]:

$$\frac{\partial P}{\partial T} = 1 - S = \frac{M - Q}{M} \tag{A.15}$$

9. This formula no longer depends on the per unit marginal cost and is wrong for the reason explained above.

[3] Singer Report ¶¶358-360.

APPENDIX E

Technical Appendix

I. DR. RYSMAN'S DAMAGES CALCULATIONS DEPEND CRUCIALLY ON TWO (AND ONLY TWO) INPUTS

1. Dr. Rysman provides the expression for consumer damages (the change in income for consumers to be at the same welfare level in the actual world as in the but-for) in Eq. 10 of Appendix F of his report:

(1) $$\Delta y = y\left[\frac{\left(\frac{(1-\tau_2)}{(1-t_2)}\frac{y}{F}-1\right)\left(\frac{(\rho-1)(1-\tau_2)}{(1-t_2)}\frac{y}{F}+1\right)^{\rho-1}}{\left(\frac{(1-\tau_1)}{(1-t_1)}\frac{y}{F}-1\right)\left(\frac{(\rho-1)(1-\tau_1)}{(1-t_1)}\frac{y}{F}+1\right)^{\rho-1}}-1\right]$$

2. Because the value Dr. Rysman uses for consumer expenditure (y) is over two million times his estimate of the fixed cost of entry (F), this expression is approximately (with over 99.999% accuracy) equal to[1]:

(2) $$\Delta y = y\left[\left(\frac{1-\tau_2}{1-\tau_1}\cdot\frac{1-t_1}{1-t_2}\right)^{\rho}-1\right]$$

3. Therefore, Dr. Rysman's consumer damages calculation depends crucially on two (and only two) inputs to his model: (1) the value of the model parameter, ρ, which relates to the

[1] One could obtain this same equation making the simplification assumption that apps do not consider the effect of their individual prices on the market price index (as that effect goes to zero as the number of apps becomes large). Rysman Report, Appendix F, p. F-4, fn. 7.

elasticity of app demand and, given the restrictiveness of Dr. Rysman's chosen demand system, the cross elasticity of demand between apps, and (2) the but-for fee.

4. Dr. Rysman's consumer damages calculation is very sensitive to these inputs. Dr. Rysman's value for ρ is based on the Ghose and Han (2014)[2] estimate of app-level elasticity of demand. Using the reported results in Ghose and Han (2014), the 95% confidence interval for their estimate of the elasticity demand is [-4.601,-2.861]. At the high end of this range (in absolute value), the implied value of ρ is 1.278. The consumer damages calculated using Dr. Rysman's model, but with this value of ρ, are 7.3%, or [redacted] lower, than Dr. Rysman's calculation based on $\rho = 1.367$.

5. A further problem with Dr. Rysman's use of the Ghose and Han estimate is that, while Ghose and Han estimated the elasticity for *only* the top 400 paid apps[3], Dr. Rysman applied this elasticity to *all* paid apps. Dr. Rysman's extrapolation of the elasticity for the top 400 paid apps to all paid apps is flawed because, under the logit model that Ghose and Han use, the own elasticity of demand for an app is negatively related (in absolute value) to the app's share. Thus, the paid apps that Ghose and Han excluded from their estimation, which by definition were of smaller share than the paid apps they included, would have larger (in absolute value) own elasticities of demand than the top 400 paid apps. This in turn means that Dr. Rysman should have adjusted the Ghose and Han elasticity of demand upward (or, equivalently, ρ downward) before using it as the elasticity of demand for all paid apps.

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[2] A. Ghose and S. Han, "Estimating demand for mobile applications in the new economy," *Management Science*, 60 (2014), pp. 1470-1488.

[3] Ghose and Han, p. 1471. They also include the top 400 free apps in their analysis. Dr. Rysman, in contrast, ignores free apps entirely.

6. For example, in the context of Dr. Rysman's model where apps all have the same quality, the top 400 apps could have higher share only by having a lower price. The elasticity of demand for app i in a logit setting is $e_i = -\beta p_i(1 - s_i)$ where β is the price coefficient, p_i is the price of app i and s_i is the share of app i. Because the share of even a top 400 app is small, $e_i \approx -\beta p_i$. In the logit context, the log of the ratio of shares of two apps is $\ln\left(\frac{s_1}{s_2}\right) = -\beta(p_1 - p_2) \approx e_1 - e_2$. The share of a top 400 app is about 20 times the share of a non-top 400 app.[4] Thus, the elasticity of demand of a non-top 400 app would exceed that of a top 400 app (in absolute value) by 3 ($\ln(20) \approx 3$). So, if the elasticity of demand of a top 400 app is -3.731, the elasticity of demand for a non-top 400 app would be -6.731 on average. Taking a weighted average of these two elasticities using revenue shares (calculated based on the quantity shares and the prices implied by those shares) of the top 400 apps and non-top 400 apps, respectively, as weights yields an overall average elasticity of -6.729. Had Dr. Rysman used this figure instead of -3.731, his variety consumer damages would be reduced by 53.2% and his combined variety/overcharge damage would be reduced by 15.6%.

7. A further problem with Dr. Rysman's use of the Ghose and Han elasticity estimate is that the instruments Ghose and Han used are likely invalid.[5] Accordingly, their estimate is likely biased downward. This, in turn, means that Dr. Rysman's damages calculations are biased upward.

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[4] Ghose and Han, Table 1, report that the average share of the top 400 apps they included in their analysis to be 0.002%. At the time they collected their data, the Google Play store had about 700 thousand apps. https://www.statista.com/statistics/266210/number-of-available-applications-in-the-google-play-store/.

[5] T. Armstrong, "Large market asymptotics for differentiated product demand estimators with economic models of supply," *Econometrica*, 84 (2016), pp. 1961-1980 shows that BLP-style instruments are likely invalid in the context of a large number of products each with a very small share, as is the case here. Hausman-style instruments are also likely invalid because demand shocks for an app on iOS are likely to be correlated with demand shocks for the same app on Android.

II. THE SERVICE FEE PASS-THROUGH RATE THAT EMERGES FROM DR. RYSMAN'S MODEL DEPENDS ON THE DEMAND SYSTEM THAT THE MODEL ASSUMES

8. I demonstrate this proposition by example. I replace Dr. Rysman's choice of demand system with an alternative demand system, but otherwise retain the other fundamental aspects of Dr. Rysman's model (many of which are themselves flawed as I discuss elsewhere). I show that the pass-through rate is well below 100% with this alternative demand system assumption.

9. Suppose that the demand for Android apps is of the "logit" form.[6] Specifically, suppose that demand for Android app i is

(3) $$q_i = \frac{\exp(-\beta p_i)}{\theta + \sum_{j=1}^{n} \exp(-\beta p_j)}$$

10. The parameter θ allows the Android app segment to have a non-zero segment elasticity of demand.[7] As in Dr. Rysman's model, I assume the apps are "symmetric," so that, in equilibrium, price and quantity will be the same for each app. In equilibrium, the elasticity of demand for each app will be

(4) $$e_A = -\beta(1-q)p$$

and the Android app segment elasticity of demand will be

(5) $$e_S = -\beta(1-nq)p.$$

6 As I discuss in the text of my report, Dr. Singer assumes that demand for apps is of the logit form for certain analyses in his report. By using it in this example, I am not suggesting that logit is the appropriate demand model for Android apps. Rather, I am simply demonstrating that the pass-through rate in Dr. Rysman's model is dependent on his choice of demand system. Given that he performed no empirical analysis to support his particular choice of demand system, Dr. Rysman has no basis to assume 100% pass-through.

7 Dr. Rysman's model assumes that the expenditure on apps remains fixed regardless of app pricing. Rysman Report, Appendix F, ¶ 5. This means that as the price of all apps increases by 10%, the total quantity of apps demanded must decrease by approximately 10% to ensure that expenditure on apps remains constant. Put another way, Dr. Rysman is assuming that the segment elasticity for Android apps is -1.

11. Given "actual world" values for the app and segment elasticities and p and n, the parameters β and θ can be calibrated by solving equations (4) and (5) after substitution of (3) and imposition of symmetry.[8] As in Dr. Rysman's model, I assume the "actual world" app elasticity to be -3.7, the "actual world" segment elasticity to be -1, and the "actual world" number of apps to be 465,262. The "actual world" price can be assumed to be $1 without loss of generality.

12. Based on the FOC for an app's profit maximization problem and symmetry, the equilibrium price for each app is

(6) $$p = \frac{c}{1-\tau} + \frac{1}{\beta(1-q)}$$

Given the calibrated β and θ and the "actual world" values of p, n, and τ (assumed to be 0.29, the value Dr. Rysman used), (6) can be solved for c. Finally, the fixed cost of entry F can be calibrated as

(7) $$F = \big((1-\tau)p - c\big)q$$

where p and τ are at their "actual world" values and q is calculated using (3), the "actual world" values of p and n, and the calibrated values of parameters β and θ.[9]

13. For Dr. Rysman's but-for world in which n is assumed fixed at its actual level, the but-for value of p can be determined by solving (6) with $\tau = 0.15$ and c, β, and θ set to their calibrated values. I calculate the pass-through rate, defined as

(8) $$PTR = \frac{p_A - p_{BF}}{0.29p_A - 0.15p_{BF}}$$

[8] The calibrated values of β and θ are 3.7 and 3.0e-7, respectively.

[9] The calibrated values of c and θ, and F are 0.52, 3.0e-7, and 4260.3.

to be 76%. For Dr. Rysman's but-for world in which both p and n are allowed to change from their actual levels, the consumer damages ("overcharge" and "variety") are only 21% of consumer expenditure, as opposed to 28% using Dr. Rysman's model.

14. Thus, if Dr. Rysman had used the logit model instead of the CES model, he would have found a lower service fee pass-through rate and lower damages. As noted above, this is just an illustration of how a different choice of demand system could lead to different results. There are many other demand systems beyond logit and CES that Dr. Rysman could have used.

III. Dr. Rysman's Model Ignores Consumer Search Costs

15. In his model, Dr. Rysman implicitly assumes consumers have perfect information regarding every app's existence, price, and quality. But, this assumption is not consistent with the real world. For example, one of the forms of value Google Play generates for app developers is "discovery value," i.e., helping apps find a user base among consumers. I show that, in a model that relaxes the perfect information assumption, the pass-through rate can vary widely depending on the model's parameters, so that the "overcharge" damages can be minimal. Moreover, the "variety" effect to which Dr. Rysman attributes substantial damages can also be minimal.

16. The starting point for this alternative model is that consumers are not aware of each of the millions of apps available in the Google Play store and spend time searching through the store to discover prices, quality, and even the identity of apps available to download. Given the large number of available apps and the opportunity cost of time, most consumers do not search the entire set of available apps, even within a category, to find their most preferred app. Rather, a consumer will discover only a subset of available apps and choose from among that subset. Consumers explore fewer apps before purchasing if it is more costly to discover each one. The higher the cost

of exploring, the fewer apps each consumer explores, and the smaller the subset of apps from which each consumer chooses. With the smaller number of apps in a consumer's choice set, each app faces less competition from other apps and is therefore able to charge a higher margin. A further consequence is that an app would pass through less of a lower but-for service fee.

17. I use a sequential search model of monopolistic competition with imperfect information.[10] I assume there are n apps, each with marginal cost equal to c. There is a unit mass of consumers. Each consumer j has tastes described by a conditional utility function (net of any search cost) of the form

(9) $$u_{ji}(p_i) = -p_i + \epsilon_{ji}$$

if she buys app i at price p_i. Parameter ϵ_{ji} is the realization of random variable and can be interpreted as a match value between consumer j and app i, and these match values are assumed to be independent across consumers and apps.

18. A consumer must incur a search cost s to learn the price charged by any particular app as well as her match value for the app sold by that firm. Consumers search sequentially with costless recall, i.e., after exploring a given app, the consumer decides whether she to pay a search cost s to explore another app in hopes of finding a better match or to stop and purchase the app with the best match among those apps she had explored so far. If she decides to search further, she repeats this process in the next step, deciding whether to stop searching after exploring one more app or continuing to search.

[10] S. Anderson and R. Renault, "Pricing, product diversity, and search costs: A Bertrand-Chamberlin-Diamond model," *RAND Journal of Economics*, 30 (1999), pp. 719-735.

19. Using results for the equilibrium price[11] from Anderson and Renault (1999), one can show that if the match parameter ϵ is drawn from standard uniform distribution, the equilibrium price is[12]

(10) $$p = \frac{c}{1-\tau} - \frac{D(p_i,p)}{\frac{\partial D(p_i,p)}{\partial p_i}} = \frac{c}{1-\tau} + \frac{\sqrt{2s}}{1-(1-\sqrt{2s})^n}$$

where n is the overall number of available apps and τ is the service fee. As the search cost s approaches zero (Dr. Rysman's perfect information assumption), the pass-through rate approaches 100% as in Dr. Rysman's model for large n and positive marginal cost. If, however, the search cost is positive, the pass-through rate is strictly less than 100%, decreases in the app's marginal cost c, and converges to zero as c approaches zero from above. This is true even as n approaches infinity.

(11) $$Pass\ Through = \frac{p_2 - p_1}{\tau_2 p_2 - \tau_1 p_1} = \frac{1}{1+\frac{\sqrt{2}\sqrt{s}(1-\tau_1)(1-\tau_2)}{c\left(1-(1-\sqrt{2}\sqrt{s})^n\right)}} \overset{n\to\infty}{\rightarrow} \frac{1}{1+\frac{\sqrt{2}\sqrt{s}(1-\tau_1)(1-\tau_2)}{c}} < 1$$

20. In addition, the variety effect in this model would be negligible as long as the large majority of consumers reach their optimal stopping point on app search short of n in the actual world. For such a consumer, increasing n in the but-for world would have no effect on their welfare (holding app prices constant); that is, there is no significant "variety" effect in this model. Only a consumer who, in the actual world, explored all n apps and would have been willing to incur the search cost

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[11] Anderson and Renault, p. 723, equation 7.

[12] I use the assumption of a uniform distribution here so that the solution is of closed form, but the basic results hold for any distribution of the match parameter with a log-concave and continuously differentiable density f whose support is an interval [a, b] of the extended real line as shown by Anderson and Renault.

to explore at least one additional app (if available) would have benefited from additional apps in the but-for world. However, very few consumers, if any, explore all n apps.

IV. DR. RYSMAN'S MODEL IGNORES APP DIRECT NETWORK EFFECTS

21. Network effects are often broken down conceptually into two different types: direct and indirect. Direct network effects occur when the value of a product or service increases with the number of users or amount of usage because the network is larger. Indirect network effects, on the other hand, occur when a platform has two or more user groups, such as app developers and consumers in the case of Google Play. As more apps are available in the Google Play store, consumers receive a greater value from the store. Dr. Rysman's model ignores the direct network effects and focuses only on the indirect network effect associated with greater "variety."

22. I address this issue by augmenting Dr. Rysman's model to account for the situation where a consumer's value from an app depends on the amount of usage of the app by other consumers. Direct network effects are likely to be important for many apps, such as dating apps and games, for example. With the introduction of direct network effects to the model, a consumer's utility from using an app increases if the usage of the app by other consumers increases. Now consider the experiment Dr. Rysman runs to calculate consumer damages. He asks how much more budget would have to be given to consumers to spend on apps in the actual world to make them as well off as they would have been in the but-for world. When his model is augmented to account for direct network effects, a given increase in budget in the actual world would have led to more expenditure on the apps that existed in the actual world and thus more usage of those apps. This increase in usage would, through the direct network effects, increase the quality of the apps that existed in the actual world, and the higher app quality would have benefited consumers. Thus, in

the augmented Rysman model with direct network effects, a smaller budget increase in the actual world would have been required to make consumers as well off as in the but-for world than in the original, unaugmented Rysman model that does not take direct network effects into account. Because this budget increase is Dr. Rysman's measure of consumer damages, the augmented model with direct network effects produces lower consumer damages than Dr. Rysman's original model.

23. Dr. Rysman assumes consumers have the following CES utility function:

$$(12)\qquad u = \left(\sum_{i=1}^{n} (a_i q_i)^{\frac{1}{\rho}}\right)^{\rho}$$

With this utility function, consumer welfare increases in equilibrium as the number of firms on the market increases ceteris paribus. However, this utility function does not incorporate the fact consumer welfare also increases if a greater number of other consumers use the same app (direct network effects). To add direct network effects into the model, I assume that an app's quality a_i is proportional to the equilibrium usage of the app by consumers, i.e., $a_i = \hat{q}_i^r\ \forall i,$ where $0 \leq r < \rho - 1$ allows for varying strength of the direct network effect. The case of $r = 0$ corresponds to Dr. Rysman's model.

24. I assume that each individual consumer does not internalize her effect on the app's quality; hence each individual consumer perceives the app's quality $a_i = \hat{q}_i^r$ as fixed.[13] As in Dr.

[13] Due to the large number of consumers, the impact of each individual consumer on the app's quality is negligible. Moreover, each individual consumer does not derive any direct network effect value from the fact that she herself uses the app. As a result, if the consumer decides to purchase and use the app, it does not change the app's quality for that consumer per se, while still increasing the quality of the app (slightly) for all other consumers purchasing it.

Rysman's model, the consumer optimization problem leads to the demand for app *i* being given by:

$$(13) \qquad q_i = \frac{y}{1-t} \cdot \frac{(a_i \bar{p})^{\frac{1}{\rho-1}}}{p_i^{\frac{\rho}{\rho-1}}} = \frac{y}{1-t} \cdot \frac{(\hat{q}_i^r \bar{p})^{\frac{1}{\rho-1}}}{p_i^{\frac{\rho}{\rho-1}}}$$

$$\text{where } \bar{p} = \left(\sum_{i=1}^{n} \left(\frac{p_i}{a_i}\right)^{\frac{1}{1-\rho}}\right)^{1-\rho} = \left(\sum_{i=1}^{n} \left(\frac{p_i}{\hat{q}_i^r}\right)^{\frac{1}{1-\rho}}\right)^{1-\rho}$$

25. Unlike consumers, developers do internalize that consumers prefer apps that a higher number of other consumers use, i.e., apps with higher demand q_i. As a result, each firm sees its app's quality $\hat{q}_i^r$ not as a constant but as a function of its demand, and hence have an additional incentive to lower the price to attract more consumers since it would increase the app's quality and attracts even more consumers. As a result, according to equation (13), the firm's demand equals

$$(14) \qquad q_i = \hat{q}_i = \left(\frac{y}{1-t}\right)^{\frac{\rho-1}{\rho-r-1}} \cdot \frac{\bar{p}^{\frac{1}{\rho-r-1}}}{p_i^{\frac{\rho}{\rho-r-1}}}$$

26. Each developer i sets the price of its app p_i to maximize its profit

$$(15) \qquad \pi_i = \big((1-\tau)p_i - c\big) \cdot q_i = \big((1-\tau)p_i - c\big) \cdot \left(\frac{y}{1-t}\right)^{\frac{\rho-1}{\rho-r-1}} \cdot \frac{\bar{p}^{\frac{1}{\rho-r-1}}}{p_i^{\frac{\rho}{\rho-r-1}}}$$

To get a more tractable solution, I make the assumption that each developer does not internalize the effect of their price on market price index $\bar{p}$.[14] As a result, the equilibrium price and quantity can be expressed as:

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[14] Dr. Rysman references this same assumption. Rysman Report, Appendix F, fn. 7. This assumption can be easily relaxed, leading to the equilibrium price expression $\hat{p} = \frac{\rho n-1}{(1+r)n-1} \cdot \frac{\rho c}{1-\tau}$ and equilibrium number of firms on the

(16) $\hat{p} = \frac{\rho c}{(1-\tau)(1+r)}$

(17) $\hat{q} = \frac{y}{(1-t)n\hat{p}} = \frac{y(1-\tau)(1+r)}{(1-t)\rho c} \cdot \frac{1}{n}$

27. One also can show that under the assumption that firms do not internalize their effect on market price index $\bar{p}$, the equilibrium number of firms on the market is given by:

(18) $n = \frac{y(1-\tau)(\rho-r-1)}{(1-t)\rho F}$

Plugging the above expression for equilibrium price and number of firms on the market into the utility function yields:

(19) $$u = \left(\sum_{i=1}^{n} (a_i q_i)^{\frac{1}{\rho}}\right)^{\rho} = \left(\sum_{i=1}^{n} (\hat{q}^{1+r})^{\frac{1}{\rho}}\right)^{\rho}$$
$$= \left(n \cdot \hat{q}^{\frac{1+r}{\rho}}\right)^{\rho} = n^{\rho} \cdot \hat{q}^{1+r} = n^{\rho-r-1}\left(\frac{y}{(1-t)\hat{p}}\right)^{1+r}.$$

Using the same approach as Dr. Rysman, the change in budget in the actual world required to make consumers as well off in the actual world as in the but-for world, Δy, is given as the solution for:

(20) $n_1^{\rho-r-1}\left(\frac{y+\Delta y}{(1-t_1)\hat{p}_1}\right)^{1+r} = n_2^{\rho-r-1}\left(\frac{y}{(1-t_2)\hat{p}_2}\right)^{1+r}$

Solving (20) for Δy yields:

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market $n = \frac{1+\frac{y(1-\tau)(\rho-r-1)}{(1-t)F}}{\rho}$. When the number of firms on the market n and consumer budget y is large, the model's predicted market outcomes with more and less relaxed assumptions are very similar.

$$(21)\quad \Delta y = y \cdot \left[\left(\frac{\hat{p}_1(1-t_1)}{\hat{p}_2(1-t_2)} \right) \cdot \left(\frac{n_2}{n_1} \right)^{\frac{\rho-r-1}{1+r}} - 1 \right] = y \cdot \left[\underbrace{\left(\frac{\hat{p}_1(1-t_1)}{\hat{p}_2(1-t_2)} \right)}_{\substack{overcharge \\ effect}} \cdot \overbrace{\left(\frac{n_2}{n_1} \right)^{\rho-1}}^{variety\ effect} \cdot \underbrace{\left(\frac{n_2}{n_1} \right)^{-\frac{\rho r}{1+r}}}_{\substack{direct \\ network\ effect}} - 1 \right]$$

Plugging equations (16) and (18) for prices and number of firms, respectively, into (21) and simplifying, yields:

$$(21)\quad \Delta y = y \cdot \left[\left(\frac{(1-\tau_2)(1-t_1)}{(1-\tau_1)(1-t_2)} \right)^{\frac{\rho}{1+r}} - 1 \right]$$

$$= y \cdot \left[\underbrace{\left(\frac{(1-\tau_2)(1-t_1)}{(1-\tau_1)(1-t_2)} \right)}_{\substack{overcharge \\ effect}} \cdot \overbrace{\left(\frac{(1-\tau_2)(1-t_1)}{(1-\tau_1)(1-t_2)} \right)^{\rho-1}}^{variety\ effect} \cdot \underbrace{\left(\frac{(1-\tau_2)(1-t_1)}{(1-\tau_1)(1-t_2)} \right)^{-\frac{\rho r}{1+r}}}_{\substack{direct \\ network\ effect}} - 1 \right]$$

For reference, the expression that does not account for direct network effects is:

$$(22)\quad \Delta y = y \cdot \left[\left(\frac{(1-\tau_2)(1-t_1)}{(1-\tau_1)(1-t_2)} \right)^{\rho} - 1 \right] = y \cdot \left[\underbrace{\left(\frac{(1-\tau_2)(1-t_1)}{(1-\tau_1)(1-t_2)} \right)}_{\substack{overcharge \\ effect}} \cdot \overbrace{\left(\frac{(1-\tau_2)(1-t_1)}{(1-\tau_1)(1-t_2)} \right)^{\rho-1}}^{variety\ effect} - 1 \right]$$

Using the values for $\tau_1, \tau_2, t_1, t_2,$ and ρ used by Dr. Rysman, I find that the direct effect entirely offsets the indirect effect as the level of the direct effect, r, approaches the value of $\rho - 1 = 0.37$.[15] In that case, "variety"-only damages are zero and combined overcharge/variety damages

[15] Because Ghose and Han controlled for factors related to number of users of an app in their econometric analysis, their elasticity estimate represents the effect of price holding the direct network effect constant and therefore this estimate can still be used to calculate ρ (subject to the other issues I have identified).

are calculated to be only 19.8% of consumer spending on apps, compared to 28.0% of consumer spending as claimed by Dr. Rysman.

V. Dr. Rysman's Model Fails to Properly Reflect the Nature of Product Differentiation Among Apps

28. Dr. Rysman's model assumes that all paid Android apps compete equally with each other. However, as discussed in the text of my report, this assumption is incorrect—Android apps vary in the nature of the functionality they provide users. As a result, an Android app does not compete equally with all other Android apps. Rather, it competes more closely with other apps that offer similar functionality than with apps that offer different functionality. Dr. Rysman could have used a "nested" CES model to capture this market reality. In such a model, products that compete closely with each other are grouped into a "nests." For example, weather apps might be grouped together into a nest because, given they are providing similar functionality, they might be expected to compete more closely with each other than with apps providing different types of functionality. In a nested CES model, there are multiple consumer preference parameters rather than just one. In the simplest version (which, as with Dr. Rysman's non-nested model, is likely to miss important complexities of the real world marketplace), there would be a parameter representing consumer preferences for variety *among* nests and a parameter representing consumer preferences for variety among apps *within* a nest.

29. It is reasonable to suppose that the consumer preference for variety among nests would be larger than the consumer preference for variety of apps within a nest. For example, consider the weather apps. Adding an additional weather app, once multiple weather apps already existed, is likely to be less important to consumers than adding the first weather app (which would create the weather app nest) to the list of existing nests.

30. At the same time, the proposition that entirely new types of apps (i.e., nests) that never existed before would have been invented in the but-for world seems unlikely and certainly Dr. Rysman provides no support for it.[16] Rather, any new entry likely would have been limited to new apps within existing nests. However, as noted above, adding additional apps to existing nests is likely to be of relatively limited value to consumers.

31. In addition, if Dr. Rysman's model is generalized to allow for nests, in principle all of the model parameters may differ by nest. For example, some nests may have a lower fixed cost of entry than others, or a different app own elasticity of demand. Differences in parameters across nests could lead to a different number of apps per nest in the actual world (an outcome that would be consistent with the real world). Nests with a relatively small number of apps may not be able to accommodate the amount of entry that the simpler version of Dr. Rysman's model predicts (due to the "integer problem" that the simpler version ignores[17]). In that case, the "variety" damages would be less than Dr. Rysman's model calculates.

VI. Dr. Rysman's Model Incorrectly Assumes That Apps Are Symmetric

32. Dr. Rysman assumes in his model that apps are symmetric—all apps are assumed to have the same marginal cost, the same demand function, and, within the demand function, a quality

[16] If creating a new type of app that was valuable to consumers was economically feasible, we would have expected to have already seen it occur in the actual world. Developers would have a strong incentive to create such a new type of app given that it would be the only seller of the new type, at least initially, and would have a first-mover advantage even if other developers entered subsequently. The profit opportunity involved in creating a new type of app that was of value to consumers would be greater than the profit opportunity involved in entering an existing nest. Thus, it should have already occurred in the actual world or the costs of creating a new type of app far exceed the costs of creating a new app for an existing nest.

[17] Rysman Report, Appendix F, ¶ 13.

parameter equal to 1.[18] He claims that his symmetry assumptions are justified because "ex ante"—at the time the app's price is set, but before the app is actually introduced on the marketplace—the developer has no idea as to what the app's marginal cost or quality will be and thus all apps can be thought of as the same (symmetric) when the price is seg. In the text of the report, I discuss why this claim of ex ante symmetry is inconsistent with real world market facts. However, even taking Dr. Rysman's claim of ex ante symmetry as given, it does not allow Dr. Rysman to derive the tractable equations on which he bases his damages calculations. Rather, Dr. Rysman makes an unjustified leap in his derivation.

33. To start, Dr. Rysman is not clear as to what information he is assuming an app developer has when setting its price. For example, the expectations operator appears in the equation in Rysman Report Appendix F ¶ 8. Although Dr. Rysman does not specify, presumably the developer is taking expectations over the joint distribution of the quality parameters a_i for all apps. However, Dr. Rysman does not say whether the developer is assumed to know that ex ante symmetry among apps prevails, what the joint distribution of the a_i is, or whether all developers have knowledge of that distribution. Nor does Dr. Rysman explain why the marginal cost is assumed to be deterministic (and the same for all apps) in this equation, especially given that he later attempts to justify the symmetry of marginal cost along the same lines as the app quality.

34. After some manipulation, Dr. Rysman arrives at the equation in Rysman Report, Appendix F, ¶ 11. Then, in the first sentence of Rysman Report, Appendix F, ¶ 12, he states "Let $a_i = 1 \; \forall i$."

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[18] In Dr. Rysman's model, the parameter a_i can be thought of as a parameter reflecting the relative quality of app i (Rysman Report, Appendix F, ¶ 4). If all apps have the same quality parameter, they all have the same relative quality. Dr. Rysman goes further and assumes the quality parameter is equal to 1 for all apps. This is harmless in his main model, but has the curious (and unsupported) implication that apps are of the same "quality" as the numeraire good in the version of his model where he incorporates an "outside good."

However, this assumption that all apps have quality parameter equal to 1 is not an implication of the equation in Rysman Report, Appendix F, ¶ 11, nor is it a harmless assumption. In fact, it is valid only if the second expectation in the equation in Rysman Report, Appendix F, ¶ 11 is equal to $1/n^2$. However, the second expectation is not equal to $1/n^2$ in general and evaluating it requires knowledge of the joint distribution of the a_i. Thus, contrary to Dr. Rysman's claim, the "ex ante symmetry" assumption does not allow him to assume that $a_i = 1\ \forall i$ and thereby reach his tractable formulas. Rather, the way he reaches those tractable formulas is to assume that apps are *ex post* symmetric in that they are all known to have the same value of 1 for the quality parameter. Rather than be upfront about this assumption—likely because it is obviously untenable—Dr. Rysman attempts a sleight of hand by making an unjustified leap from the equation in Rysman Report, Appendix F, ¶ 11 to the equation in Rysman Report, Appendix F, ¶ 12. But, as Rysman Report, Appendix F, ¶ 11 makes clear, even with ex ante symmetry, the modeler (and the developer being modeled) requires knowledge of the joint distribution of the a_i.

35. In any event, Dr. Rysman's assumption of ex ante symmetry is incorrect. Once developers are allowed to be asymmetric, i.e., when a developer setting its price is allowed to have some information regarding its app's demand or marginal cost, applying Dr. Rysman's (incorrect) symmetric model can lead to substantial errors. Again, I demonstrate this by example. I first construct a "real world" in which there is asymmetry. I then see what happens if Dr. Rysman's symmetric model is incorrectly applied to this "real world."

36. To construct the "real world," I assume there is a unit mass of consumers with an aggregate budget equal to one and there are 11 apps on the market with $\tau = 0.3$. I assume demand for apps in the "real world" is governed by the demand system used in Dr. Rysman model, except that instead of each app having quality parameter equal to 1, the 11 apps have quality parameters $a_1 =$

$1.5, a_2 = 1.4, \ldots, a_{11} = 0.5$. There are three developers who chose not to enter when $\tau = 0.3$. Had they entered, these developers' apps would have had quality parameters $a_{12} = 0.4, a_{13} = 0.3, a_{14} = 0.2$. The demand parameter ρ is set to the same value as that used by Dr. Rysman.

37. Each developer with an app on the market chooses its price to maximize its profits. The set of equilibrium prices in the "real world" jointly solve the developers' first order conditions. Because the quality parameters are not the same across apps, the "real world" equilibrium prices and demands are not the same across apps, unlike in the Rysman model. The fixed cost of entry in the "real world" is set so that the profit of the least profitable of the 11 apps on the market is zero. If app #12 (with quality parameter $a_{12} = 0.4$) entered, it would have negative profitability and thus it would not enter in equilibrium.[19]

38. I next ask what would happen in this constructed "real world" if the commission rate were decreased to $\tau = 0.15$. While the profit of each of the 11 apps on the market would increase, if app #12 entered, its profitability would still be negative. Thus, despite the lower commission rate, there would be no additional variety in the "real world" with quality asymmetry. The reason for this is that the apps that did not enter with the higher commission rate are those with relatively low quality. Even with the lower commission rate, they are not profitable because of their lower quality. There is a "selection problem"—the apps that entered are of higher average quality than the apps that did not enter.

39. An important implication of this is that, with quality asymmetry, one must analyze the quality of the apps that did not enter to determine what would happen with a lower commission

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[19] Multiple equilibria may be possible in this type of model. However, I focus on the most "efficient" equilibrium in which the apps that do not enter in equilibrium have lower quality than all the apps that do enter in equilibrium. I also focus on equilibria in pure strategies.

rate. Generally, analyzing the quality of products that never entered is difficult. Dr. Rysman's symmetry assumption allows him to avoid this difficulty. With symmetry, the quality of the apps that did not enter is the same as the quality of apps that did enter. There is no "selection problem." Thus, inferences about what would happen with a lower commission rate can be made just by looking at the apps that did enter. While assuming symmetry makes the analysis easier, it leads the analysis astray if apps are actually asymmetric.

40. To show that, I apply the symmetric Rysman model to the asymmetric "real world" I constructed above. The symmetric Rysman model incorrectly predicts that two additional apps would enter with the lower commission rate. It does so because it incorrectly assumes that the apps that did not enter at the higher commission rate were of the same average quality as the apps that did enter. It also overstates the variety damages because, even if two additional apps entered with the lower commission rate, they would be of below average quality and thus provide less additional utility to consumers than the 11 original apps.

Exhibit 1a

Price Changes of the Top 100 Paid Apps
With A Flat Service Fee Rate Reduction of 15 Percentage Points After July 2021

July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	45	32	23
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	51%	32%	18%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	15%	15%	15%	15%
Average List Price				
2020.07.01 - 2021.06.30	$8.37	$9.81	$7.30	$7.03
2021.07.01 - 2022.05.31	$8.40	$9.81	$8.15	$5.99
% List Price Change	0%	0%	12%	-15%
Based on Net Price				
Count of SKUs	100	45	32	23
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	51%	32%	18%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	15%	15%	15%	15%
Average Net Price				
2020.07.01 - 2021.06.30	$8.37	$9.81	$7.30	$7.03
2021.07.01 - 2022.05.31	$8.40	$9.81	$8.15	$5.99
% Net Price Change	0%	0%	12%	-15%

Notes:

[1] The analysis considers the top 100 paid apps ranked by total consumer spend during July 2020 and May 2022 among paid apps with non-zero sales in every month between July 2020 and May 2022, subject to a 30% service fee rate in every month between July 2020 and June 2021 and a 15% service fee rate in every month between July 2021 and May 2022.

[2] Service fee rates are first calculated at SKU-level for the pre-/post-period as the total gross Google service fee revenue divided by the total gross consumer spend in the period. The average service fee rate in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period service fee rates.

[3] List prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend divided by the total quantity purchased in the period. The average list price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period list prices.

[4] Net prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend net of developer-offered discounts divided by the total quantity purchased in the period. The average net price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period net prices.

[5] Price changes equal to or less than 1% based on the list/net prices are considered as no price change; price changes greater than 1% are counted as a price increase or price decrease.

[6] The consumer spend for each group (Total, No Price Change, Price Increase, and Price Decrease) is the total final consumer spend of all the SKUs in the group during July 2020 – May 2022.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 1b

Price Changes of the Top 100 Paid Apps
With A Service Fee Rate Reduction of At Least 10 Percentage Points in July 2021

July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	41	37	22
Consumer Spend ($)	[redacted]	[redacted]	[redacted]	[redacted]
Consumer Spend (% of the Top 100)	100%	46%	38%	16%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	16%	15%	17%	16%
Average List Price				
2020.07.01 - 2021.06.30	$8.10	$10.41	$6.65	$6.22
2021.07.01 - 2022.05.31	$8.18	$10.41	$7.42	$5.34
% List Price Change	1%	0%	11%	-14%
Based on Net Price				
Count of SKUs	100	41	37	22
Consumer Spend ($)	[redacted]	[redacted]	[redacted]	[redacted]
Consumer Spend (% of the Top 100)	100%	46%	38%	16%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	16%	15%	17%	16%
Average Net Price				
2020.07.01 - 2021.06.30	$8.10	$10.41	$6.65	$6.22
2021.07.01 - 2022.05.31	$8.18	$10.41	$7.42	$5.34
% Net Price Change	1%	0%	11%	-14%

Notes:

[1] The analysis considers the top 100 paid apps ranked by total consumer spend during July 2020 to May 2022 among paid apps with non-zero sales in every month between July 2020 and May 2022 and had a service fee rate reduction of at least 10% (i.e., from 30% to 20% or less) in the month of July 2021. The service fee rate can revert back to 30% right after July 2021, which allows the sample to include SKUs that exceeded the policy's annual $1M cap ($0.5M for 2021) between July 2021 and May 2022.

[2] Service fee rates are first calculated at SKU-level for the pre-/post-period as the total gross Google service fee revenue divided by the total gross consumer spend in the period. The average service fee rate in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period service fee rates.

[3] List prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend divided by the total quantity purchased in the period. The average list price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period list prices.

[4] Net prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend net of developer-offered discounts divided by the total quantity purchased in the period. The average net price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period net prices.

[5] Price changes equal to or less than 1% based on the list/net prices are considered as no price change; price changes greater than 1% are counted as a price increase or price decrease.

[6] The consumer spend for each group (Total, No Price Change, Price Increase, and Price Decrease) is the total final consumer spend of all the SKUs in the group during July 2020 – May 2022.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 1c

Price Changes of the Top 100 Paid Apps

July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	56	32	12
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	36%	55%	9%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	[redacted]			
Average List Price				
2020.07.01 - 2021.06.30	$7.82	$8.31	$6.30	$9.55
2021.07.01 - 2022.05.31	$8.00	$8.31	$7.03	$9.12
% List Price Change	2%	0%	12%	-5%
Based on Net Price				
Count of SKUs	100	56	32	12
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	36%	55%	9%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	[redacted]			
Average Net Price				
2020.07.01 - 2021.06.30	$7.82	$8.31	$6.30	$9.55
2021.07.01 - 2022.05.31	[redacted]			
% Net Price Change	2%	0%	12%	-5%

Notes:

[1] The analysis considers the top 100 paid apps ranked by total consumer spend between July 2020 and May 2022.

[2] Service fee rates are first calculated at SKU-level for the pre-/post-period as the total gross Google service fee revenue divided by the total gross consumer spend in the period. The average service fee rate in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period service fee rates.

[3] List prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend divided by the total quantity purchased in the period. The average list price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period list prices.

[4] Net prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend net of developer-offered discounts divided by the total quantity purchased in the period. The average net price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period net prices.

[5] Price changes equal to or less than 1% based on the list/net prices are considered as no price change; price changes greater than 1% are counted as a price increase or price decrease.

[6] The consumer spend for each group (Total, No Price Change, Price Increase, and Price Decrease) is the total final consumer spend of all the SKUs in the group during July 2020 – May 2022.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 2a

Price Changes of the Top 100 IAPs
With A Flat Service Fee Rate Reduction of 15 Percentage Points After July 2021

July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	85	14	1
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	85%	14%	1%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	15%	15%	15%	15%
Average List Price				
2020.07.01 - 2021.06.30	$28.31	$30.08	$19.31	$2.99
2021.07.01 - 2022.05.31	$29.33	$30.08	$26.67	$2.86
% List Price Change	4%	0%	38%	-4%
Based on Net Price				
Count of SKUs	100	85	14	1
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	85%	14%	1%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	15%	15%	15%	15%
Average Net Price				
2020.07.01 - 2021.06.30	$28.31	$30.08	$19.31	$2.99
2021.07.01 - 2022.05.31	$29.33	$30.08	$26.67	$2.86
% Net Price Change	4%	0%	38%	-4%

Notes:

[1] The analysis considers the top 100 IAPs ranked by total consumer spend during July 2020 and May 2022 among IAPs with non-zero sales in every month between July 2020 and May 2022, subject to a 30% service fee rate in every month between July 2020 and June 2021 and a 15% service fee rate in every month between July 2021 and May 2022.

[2] Service fee rates are first calculated at SKU-level for the pre-/post-period as the total gross Google service fee revenue divided by the total gross consumer spend in the period. The average service fee rate in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period service fee rates.

[3] List prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend divided by the total quantity purchased in the period. The average list price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period list prices.

[4] Net prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend net of developer-offered discounts divided by the total quantity purchased in the period. The average net price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period net prices.

[5] Price changes equal to or less than 1% based on the list/net prices are considered as no price change; price changes greater than 1% are counted as a price increase or price decrease.

[6] The consumer spend for each group (Total, No Price Change, Price Increase, and Price Decrease) is the total final consumer spend of all the SKUs in the group during July 2020 – May 2022.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 2b

Price Changes of the Top 100 IAPs
With A Service Fee Rate Reduction of At Least 10 Percentage Points in July 2021

July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	90	9	1
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	93%	7%	1%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	25%	25%	24%	27%
Average List Price				
2020.07.01 - 2021.06.30	$40.58	$40.28	$42.04	$54.31
2021.07.01 - 2022.05.31	$40.76	$40.29	$44.49	$49.99
% List Price Change	0%	0%	6%	-8%
Based on Net Price				
Count of SKUs	100	90	9	1
Consumer Spend ($)	[redacted]			
Consumer Spend (% of the Top 100)	100%	93%	7%	1%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	30%	30%
2021.07.01 - 2022.05.31	25%	25%	24%	27%
Average Net Price				
2020.07.01 - 2021.06.30	$40.58	$40.28	$42.04	$54.31
2021.07.01 - 2022.05.31	$40.76	$40.28	$44.49	$49.99
% Net Price Change	0%	0%	6%	-8%

Notes:

[1] The analysis considers the top 100 IAPs ranked by total consumer spend during July 2020 to May 2022 among IAPs with non-zero sales in every month between July 2020 and May 2022 and had a service fee rate reduction of at least 10% (i.e., from 30% to 20% or less) in the month of July 2021. The service fee rate can revert back to 30% right after July 2021, which allows the sample to include SKUs that exceeded the policy's annual $1M cap ($0.5M for 2021) between July 2021 and May 2022.

[2] Service fee rates are first calculated at SKU-level for the pre-/post-period as the total gross Google service fee revenue divided by the total gross consumer spend in the period. The average service fee rate in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period service fee rates.

[3] List prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend divided by the total quantity purchased in the period. The average list price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period list prices.

[4] Net prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend net of developer-offered discounts divided by the total quantity purchased in the period. The average net price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period net prices.

[5] Price changes equal to or less than 1% based on the list/net prices are considered as no price change; price changes greater than 1% are counted as a price increase or price decrease.

[6] The consumer spend for each group (Total, No Price Change, Price Increase, and Price Decrease) is the total final consumer spend of all the SKUs in the group during July 2020 – May 2022.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 2c

Price Changes of the Top 100 IAPs

July 2020 – June 2021 vs. July 2021 - May 2022

	Total	No Price Change	Price Increase	Price Decrease
Based on List Price				
Count of SKUs	100	100	0	0
Consumer Spend ($)	$3,427,332,388	$3,427,332,388	$0	$0
Consumer Spend (% of the Top 100)	100%	100%	0%	0%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	-	-
2021.07.01 - 2022.05.31	30%	30%	-	-
Average List Price				
2020.07.01 - 2021.06.30	$39.92	$39.92	-	-
2021.07.01 - 2022.05.31	$39.92	$39.92	-	-
% List Price Change	0%	0%	-	-
Based on Net Price				
Count of SKUs	100	95	0	5
Consumer Spend ($)	$3,427,332,388	$3,252,454,564	$0	$174,877,824
Consumer Spend (% of the Top 100)	100%	95%	0%	5%
Average Service Fee Rate				
2020.07.01 - 2021.06.30	30%	30%	-	30%
2021.07.01 - 2022.05.31	30%	30%	-	30%
Average Net Price				
2020.07.01 - 2021.06.30	$39.82	$40.66	-	$23.87
2021.07.01 - 2022.05.31	$39.74	$40.64	-	$22.63
% Net Price Change	0%	0%	-	-5%

Notes:

[1] The analysis considers the top 100 IAP SKUs ranked by total consumer spend between July 2020 and May 2022.

[2] Service fee rates are first calculated at SKU-level for the pre-/post-period as the total gross Google service fee revenue divided by the total gross consumer spend in the period. The average service fee rate in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period service fee rates.

[3] List prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend divided by the total quantity purchased in the period. The average list price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period list prices.

[4] Net prices are first calculated at SKU-level in the pre-/post-period as the total gross consumer spend net of developer-offered discounts divided by the total quantity purchased in the period. The average net price in the pre-/post-period is then calculated as the average across the SKU-level pre-/post-period net prices.

[5] Price changes equal to or less than 1% based on the list/net prices are considered as no price change; price changes greater than 1% are counted as a price increase or price decrease.

[6] The consumer spend for each group (Total, No Price Change, Price Increase, and Price Decrease) is the total final consumer spend of all the SKUs in the group during July 2020 – May 2022.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 3a

Comparison of New and Existing IAPs of Apps
Associated with the Top 100 IAPs with a Flat Service Fee Rate Reduction of 15 Percentage Points After July 2021

	Comparison of New vs Existing SKUs (July 2021 - May 2022)						Comparison of New SKUs 2020 (July - Dec.) vs 2021 (July - Dec.)							
	SKU Count		Avg List Price		Avg Monthly Consumer Spend		New SKU Count		Total New SKU Consumer Spend		New SKU Consumer Spend (% of Total IAP Spend for the App)		Consumer Spend (%) per New SKU	
App Package Name	**Existing**	**New**	**Existing**	**New**	**Existing**	**New**	**2020**	**2021**	**2020**	**2021**	**2020**	**2021**	**2020**	**2021**
[redacted]	46	28	21.3	19.1	$426	$112	19	28	$137,583	$13,487	27%	10%	1.4%	0.3%
[redacted]	69	25	41.5	32.1	$413	$178	0	17	$0	$5,948	0%	3%	-	0.2%
[redacted]	31	21	21.9	9.1	$1,011	$391	6	14	$3,986	$11,365	2%	5%	0.4%	0.3%
[redacted]	22	16	17.6	11.2	$2,752	$290	10	3	$50,402	$3,331	6%	1%	0.6%	0.3%
[redacted]	105	15	12.4	13.7	$235	$110	10	5	$662	$983	1%	1%	0.1%	0.2%
[redacted]	359	14	5.8	3.0	$34	$7	20	1	$291	$3	1%	0%	0.0%	0.0%
[redacted]	36	12	23.7	22.7	$2,637	$3,064	7	6	$45,399	$45,426	13%	12%	1.9%	2.0%
[redacted]	22	10	10.1	12.3	$1,458	$1,916	0	9	$0	$68,992	0%	24%	-	2.6%
[redacted]	24	10	13.8	10.8	$1,407	$928	17	7	$17,483	$7,499	11%	6%	0.6%	0.8%
[redacted]	6	7	68.3	39.1	$2,315	$232	0	7	$0	$10,361	0%	10%	-	1.4%
[redacted]	17	7	19.2	12.1	$1,623	$177	16	7	$819	$3,738	0%	2%	0.0%	0.3%
[redacted]														
[redacted]	27	5	30.0	53.0	$1,490	$888	9	4	$132,117	$9,424	38%	5%	4.3%	1.4%
[redacted]	30	3	9.3	9.8	$666	$1,079	2	3	$14,778	$20,063	4%	12%	2.2%	4.1%
[redacted]	13	3	30.0	58.7	$2,296	$497	0	3	$0	$6,046	0%	3%	-	1.0%
[redacted]	15	3	16.8	8.3	$1,117	$39	13	0	$49,128	$0	100%	0%	7.7%	-
[redacted]	6	2	8.2	75.0	$5,923	$1,625	0	2	$0	$4,349	0%	4%	-	1.8%
[redacted]	10	2	42.0	75.0	$6,890	$1,485	5	2	$28,430	$5,942	9%	1%	1.8%	0.7%
[redacted]	11	2	10.8	100.0	$4,207	$342	1	2	$470	$2,700	0%	1%	0.2%	0.5%
[redacted]	1	1	20.0	50.0	$5,995	$3,295	1	1	$57,703	$25,361	100%	59%	100.0%	59.0%
[redacted]	25	1	10.3	3.0	$1,578	$1,546	0	0	$0	$0	0%	0%	-	-
[redacted]	8	1	63.1	60.0	$1,527	$60	2	0	$1,634	$0	3%	0%	1.4%	-
[redacted]	38	1	18.5	4.0	$523	$30	3	0	$15	$0	0%	0%	0.0%	-
[redacted]	11	1	75.2	2.0	$350	$24	5	0	$2,471	$0	1%	0%	0.2%	-
[redacted]	8	1	56.9	20.0	$7,995	$20	0	0	$0	$0	0%	0%	-	-

Notes:

[1] The top 100 IAP SKUs analyzed in Exhibit 2a are associated with 72 apps, among which only 25 had new SKUs since July 2021.

[2] The average list prices and consumer spend are calculated based on data from July 2021 to May 2022. For each app, the average list price of existing (new) SKUs is calculated as the average across the post-July 2021 average prices of each existing (new) SKU of the app; the average monthly consumer spend of existing (new) SKUs is calculated the average across the post-July 2021 monthly average final consumer spend of each existing (new) SKUs of the app.

[3] “Existing” SKUs are SKUs which had their first sales anytime before July 2021 (including before July 2020), and had non-zero sales during both July 2020 – June 2021 and July 2021 – May 2022.

[4] “New” SKUs are SKUs which had their first sales during the time period indicated by the panel title and column year (i.e., July 2021 - May 2022, July - December 2020, or July - December 2021 respectively).

[5] “Consumer Spend (%) per new SKU” shows the average percentage of final consumer spend accounted for by one new SKU, i.e., “New SKU Consumer Spend (%)” divided by the number of new SKUs.

[6] Some apps launched new SKUs in the period of July 2021 - May 2022 but outside the time window of the right panel analysis (July 2021 – December 2021), thus are shown as having no new SKU in 2021 in the right panel.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 3b

[redacted]

Exhibit 3c

[redacted]

[redacted]

Notes:

[1] The analysis considers Tinder subscription SKUs with non-zero sales during July 2020 – June 2021, July 2021 – December 2021, and January 2022 – May 2022.

[2] Service fee rates are first calculated at SKU-level for each of the three periods as the total gross Google service fee revenue divided by the total gross consumer spend in the period. The average service fee rate in each of the three periods is then calculated as the across the SKU-level service fee rates in the period.

[3] List prices are first calculated at SKU-level in each of the three periods as the total gross consumer spend divided by the total quantity purchased in the period. The average list price in each of the three periods is then calculated as the average across the SKU-level list prices in the period.

[4] Net prices are first calculated at SKU-level in each of the three periods as the total gross consumer spend net of developer-offered discounts divided by the total quantity purchased in the period. The average net price in each of the three periods is then calculated as the average across the SKU-level net prices in the period.

[5] Price changes equal to or less than 1% based on the list/net prices are considered as no price change; price changes greater than 1% are counted as a price increase or price decrease.

[6] The consumer spend for each group (Total, No Price Change, Price Increase, and Price Decrease) is the total final consumer spend of all the SKUs in the group during July 2020 – May 2022.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

[redacted]

Notes:

[1] The analysis considers Tinder subscription SKUs with non-zero originating order sales during July 2020 – June 2021, July 2021 – December 2021, and January 2022 – May 2022.

[2] Service fee rates are first calculated at SKU-level using originating orders for each of the three periods as the total gross Google service fee revenue divided by the total gross consumer spend in the period. The average service fee rate in each of the three periods is then calculated as the across the SKU-level service fee rates in the period.

[3] List prices are first calculated at SKU-level using originating orders in each of the three periods as the total gross consumer spend divided by the total quantity purchased in the period. The average list price in each of the three periods is then calculated as the average across the SKU-level list prices in the period.

[4] Net prices are first calculated at SKU-level using originating orders in each of the three periods as the total gross consumer spend net of developer-offered discounts divided by the total quantity purchased in the period. The average net price in each of the three periods is then calculated as the average across the SKU-level net prices in the period.

[5] Price changes equal to or less than 1% based on the list/net prices are considered as no price change; price changes greater than 1% are counted as a price increase or price decrease.

[6] The consumer spend for each group (Total, No Price Change, Price Increase, and Price Decrease) is the total originating order final consumer spend of all the SKUs in the group during July 2020 – May 2022.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 5

Estimates of Pass-Through Rate Using Synthetic Control Estimation

Time Period: July 2020 - May 2022

Main Sample

	IAPs	Paid Downloads	Subscriptions
Pass-Through Rate	**-3.3%**	**-0.3%**	**-1.3%**
Pass-Through Rate (Upper Bound)	**2.0%**	**10.6%**	**9.7%**
P-Value	0.22	0.94	0.82
Number of Treated SKUs	16,047	3,113	2,874
Number of Control SKUs	11,507	1,404	3,295
Number of SKU-Month Obs.	633,742	103,891	141,887
Total Consumer Spend (8/16/16-5/31/22)	[redacted]		
Weighted Average Pass-Through Rate		**3.0%**	

Notes:

[1] The sample includes the treated SKUs subject to a 29.5%-30.5% service fee rate in the pre period (from July 2020 to June 2021) and 14.5%-15.5% in the post period (from July 2021 to May 2022), and the control SKUs subject to a 29.5%-30.5% service fee rate throughout July 2020 and May 2022.

[2] The sample is "balanced" by restricting to include only SKUs with non-zero sales in every month betweeen July 2020 and May 2022.

[3] A confidence interval with 95% confidence is constructed for the pass-through rate. The reported upper bound is the right end of this confidence interval.

[4] A low p-value (<= 0.05) indicates that the regression estimate is statistically significant, i.e., one can reject the null hypothesis that the regression estimate is zero; a high p-value (> 0.05) indicates that the regression estimate is not statistically significant, i.e., one cannot reject the null hypothesis that the regression estimate is zero.

[5] The weighted average pass-through rate is the upper bound of pass-through rates for IAPs, paid downloads, and subscriptions, weighted by the total class period consumer spend net of discounts for each.

Source:

[1] Google Play transaction data; GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 6

Price Comparison of Top Paid Game Apps in ONE Store vs Google Play Store

App Prices in South Korea as of October 29th, 2022 (in South Korean Won)

App Name	App Price	
	ONE Store	Google Play
The Cloud Dream of the Nine M	33,000 Won	33,000 Won
Dead Cells	21,000 Won	12,000 Won / In App Purchase
Some Some Store: Love Convenience Store	15,000 Won	15,000 Won
Miracle snack shop	14,000 Won	14,000 Won
Wonder Boy: The Dragon's Trap	10,000 Won	12,000 Won
Dawn of Flower	15,000 Won	In App Purchase
When you wish upon a star	7,000 Won	7,000 Won
Knight Run: Homecoming	11,000 Won	11,000 Won
Love Flute	10,000 Won	10,000 Won
White day: A labyrinth named school	8,800 Won	8,900 Won
Lu Bu Maker	8,000 Won	8,000 Won
DragonSpear-EX	5,900 Won	5,900 Won
She is Mermaid	5,000 Won	5,000 Won
Some Some Convenience Store / Soohee After Story	5,000 Won	5,000 Won
Istelia Story	2,300 Won	2,300 Won
Persephone	4,000 Won	6,500 Won
Shin Hayarigami - Blind man	3,300 Won	3,300 Won
Inbento	3,000 Won	2,300 Won
Cut the Rope: Time Travel	3,000 Won	Free / In App Purchase
Sweatshop Diary DX	3,000 Won	Free / In App Purchase
Memorize Season 4	3,000 Won	3,000 Won
My future girlfriend greeted me	3,000 Won	3,000 Won
Dungeon Warfare	2,900 Won	3,300 Won
The Pleiades of Dreaming Starlight	2,900 Won	2,900 Won
Shin Hayarigami - Doll	2,200 Won	2,200 Won
Decalcomanie	2,000 Won	2,500 Won
Go Stop Puzzle2	1,999 Won	Free / In App Purchase
Dead End 99	1,900 Won	1,900 Won
Hero Rescue Girl: Pin Puzzle	1,000 Won	Free

Exhibit 6

Price Comparison of Top Paid Game Apps in ONE Store vs Google Play Store

App Prices in South Korea as of October 29th, 2022 (in South Korean Won)

App Name	App Price	
	ONE Store	Google Play
Cobra Strike	1,000 Won	999 Won
Naval Warfare Korea vs Japan	1,000 Won	1,000 Won
Until She Sings Again	4,500 Won	N/A
Mole Hunter Master	100 Won	N/A
Dice Merge	100 Won	N/A
Flying Airplane	100 Won	N/A
Fishing Master PLUS	5,000 Won	N/A
2048 Classic	100 Won	N/A
Teddy Bear Forest	200 Won	N/A
Colorless Run Pro	100 Won	N/A
The Art of War - the 36th Stratagems	1,999 Won	N/A
Memory Game	100 Won	N/A
Making a Younger Sister: Part 3	1,000 Won	N/A
SPEDOG	100 Won	N/A
All Random Zombie Defense	200 Won	N/A
Eagle Strike	200 Won	N/A
Air Hockey	100 Won	N/A
Summer in the Forest - Healing Game	500 Won	N/A
Frog Jump	500 Won	N/A
Building Blocks	100 Won	N/A
Block Magic Puzzle	100 Won	N/A

Notes:

[1] The table includes top paid apps based on paid sales in ONE Store in South Korea, as of October 29, 2022.

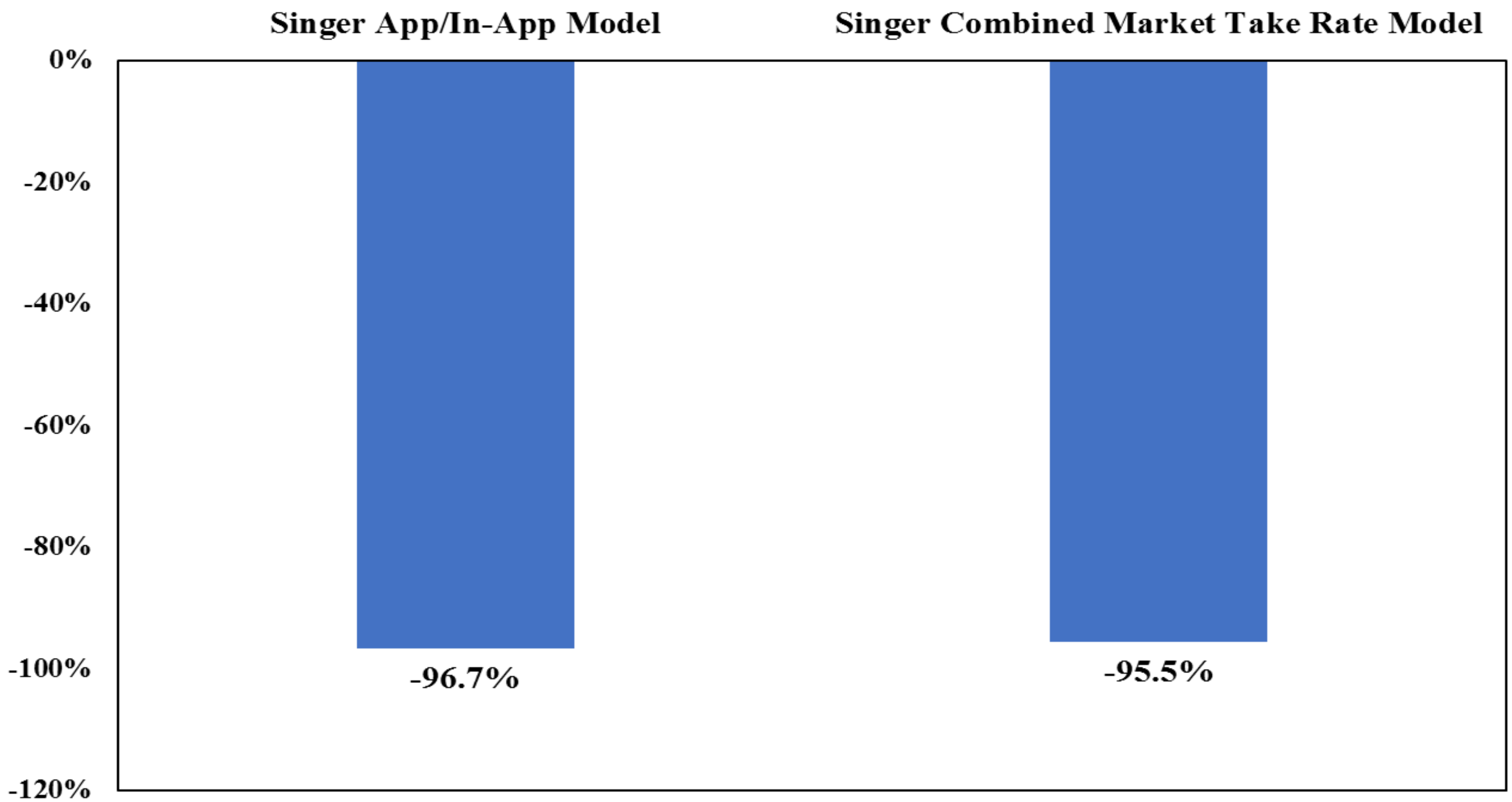
Sources:

[1] https://www.mobileindex.com/mi-chart/daily-rank

[2] App prices for each app are obtained from the ONE Store and Google Play websites as of October 30, 2022.

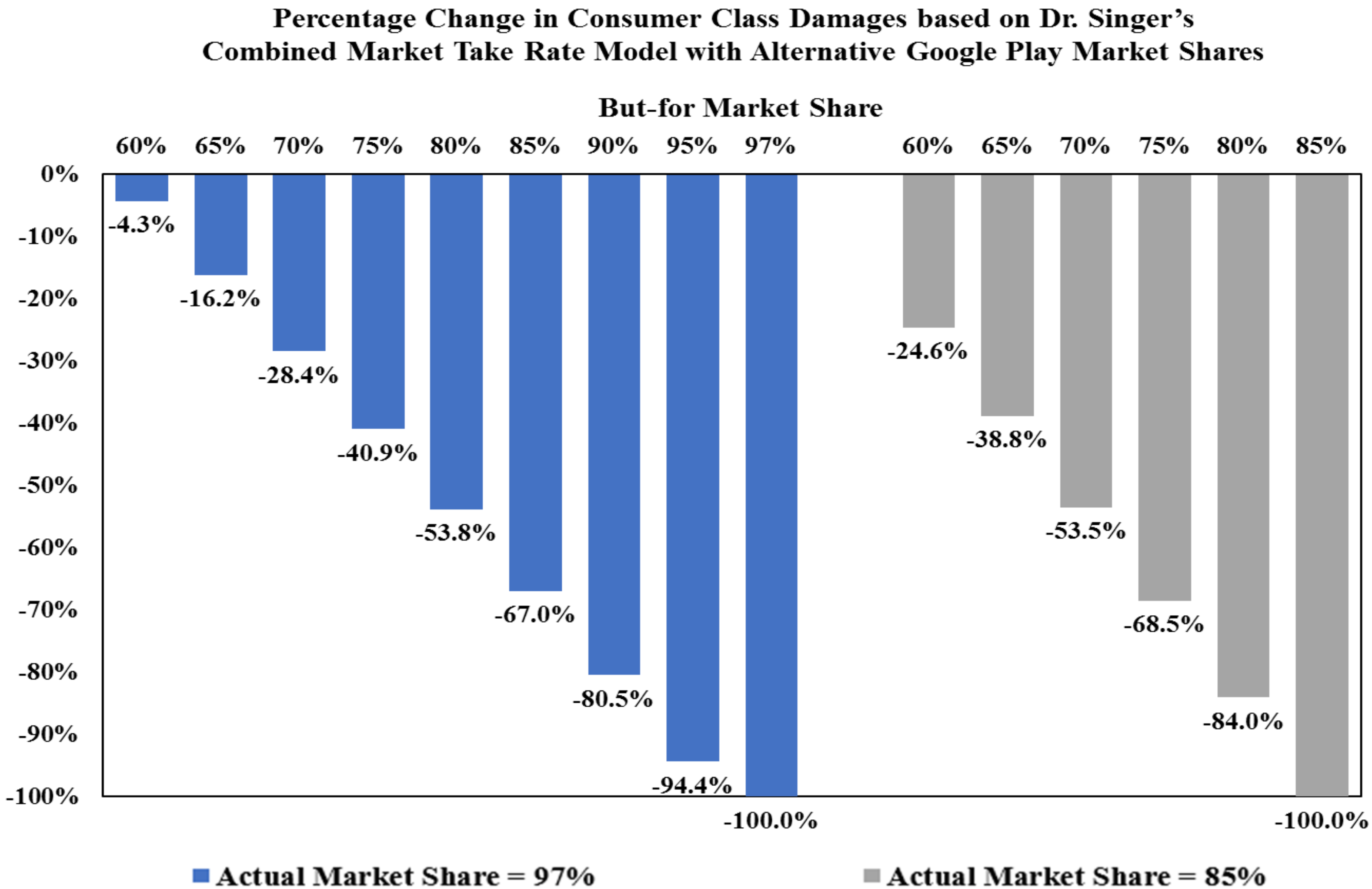
Exhibit 7a

Percentage Change in Consumer Class Damages based on Dr. Singer's Damages Models with Empirical Pass-Through Estimate (3.0%)



Sources: Exhibits 8a, 8b, and 8d.

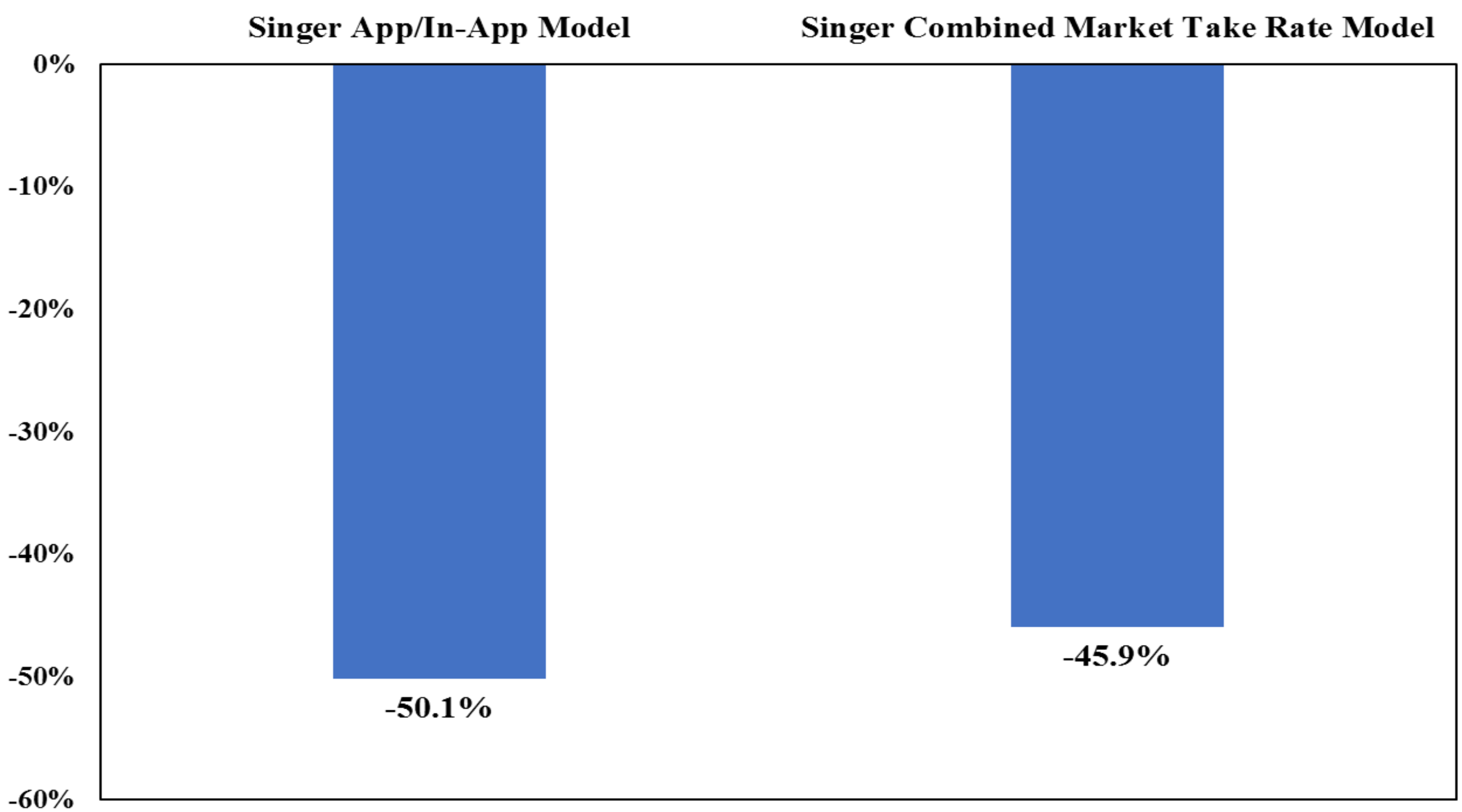
Exhibit 7b



Source: Exhibit 8d.

Exhibit 7c

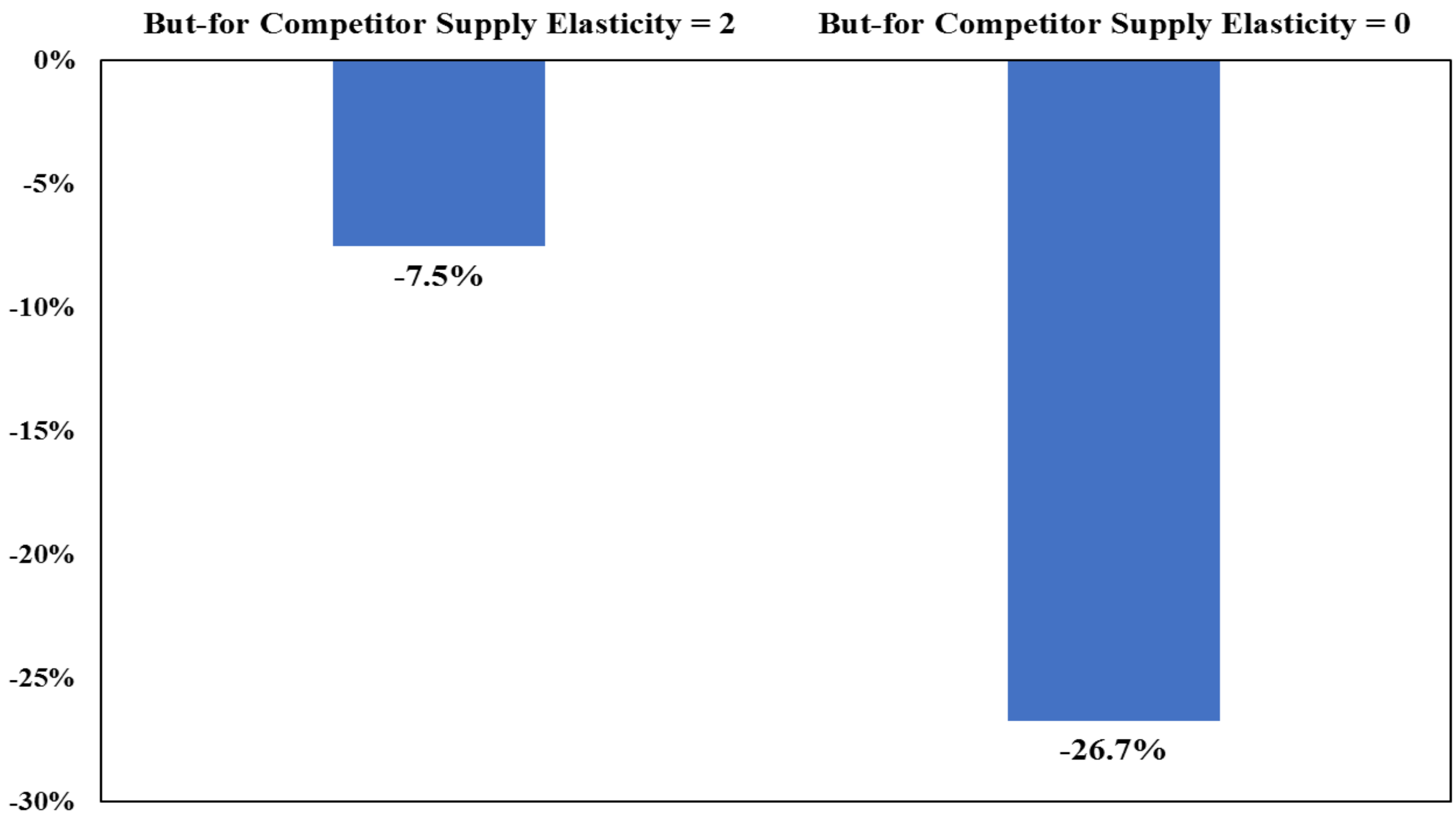
Percentage Change in Consumer Class Damages based on Dr. Singer's Damages Models with A Linear Demand Curve



Sources: Exhibits 8a, 8b, and 8d.

Exhibit 7d

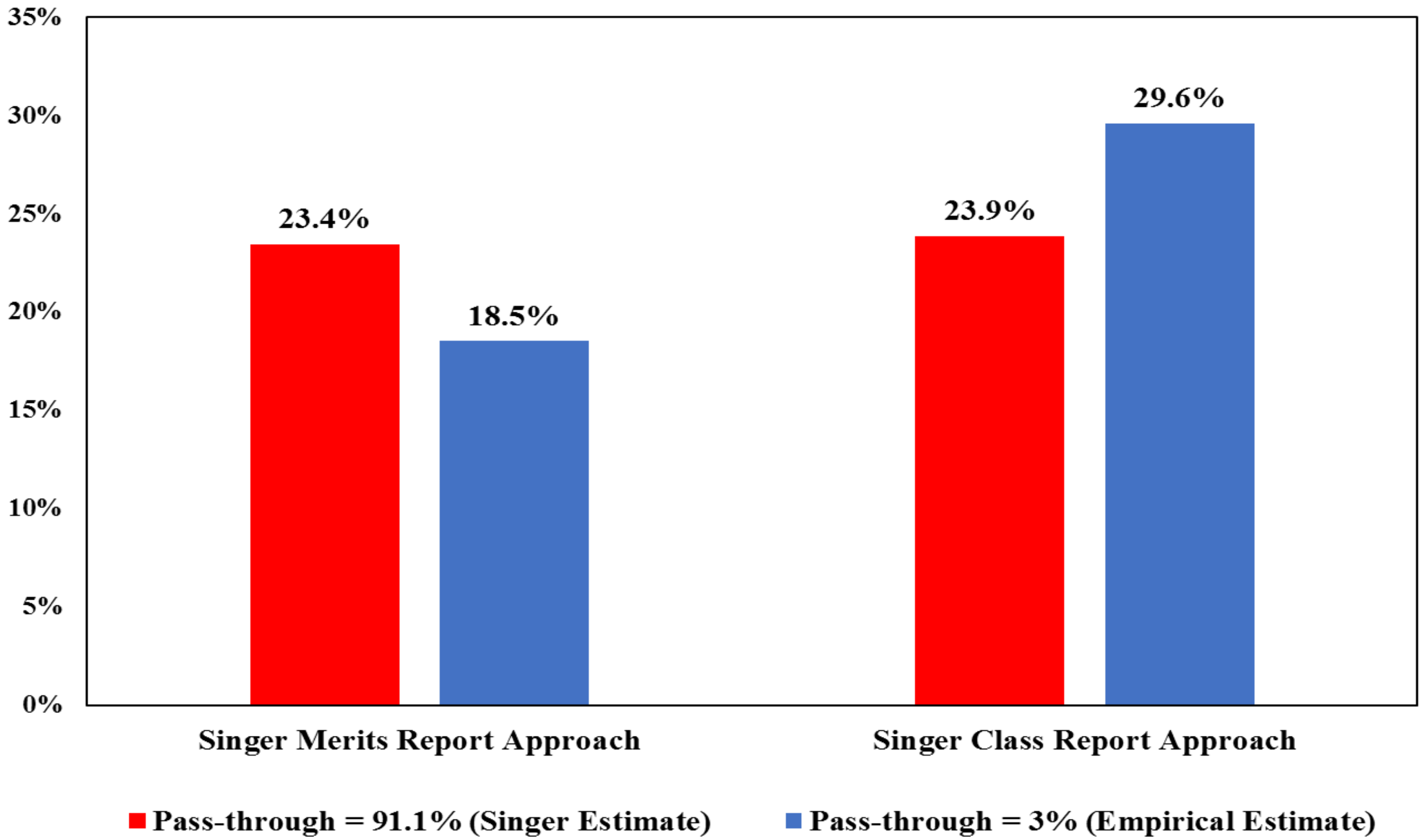
Percentage Change in Consumer Class Damages based on Dr. Singer's IAP Model with Alternative Competitor Supply Elasticities



Source: Exhibit 8b.

Exhibit 7e

But-For Take Rates based on Dr. Singer's Class Report and Merits Report
Combined Market Take Rate Model with Empirical Pass-Through Rate Estimate



Source: Singer Report Production.

Exhibit 7f

Consumer Class Damages based on Dr. Singer's Combined Market Take Rate Model

[redacted]

Source: Exhibit 8d.

Exhibit 8a

Consumer Class Damages based on Dr. Singer's App Distribution Market Model

August 16, 2016 - May 31, 2022

Model Input					Calculation Output			
Pass-Through Rate	**Google Play Actual Market Share**	**Google Play But-for Market Share**	**Actual Take Rate**	**Actual Consumer Subsidy as a Percent of Gross Consumer Spend**	**But-for Take Rate**	**But-for Consumer Subsidy as a Percent of Gross Consumer Spend**	**% Change from Dr. Singer's Damages Estimate**	[redacted]
Singer Model Original								
91.1%	**100%**	**60%**	**29.0%**	**0.7%**	**22.2%**	**0.7%**	**0%**	
Sensitivities								
1) Change Dr. Singer's input for the pass-through rate								
3.0%	100%	60%	29.0%	0.7%	**17.2%**	**0.7%**	**-95%**	
2) Change Dr. Singer's inputs for Google Play's actual and but-for market shares								
91.1%	97%	60%	29.0%	0.7%	**22.5%**	**0.7%**	**-4%**	
91.1%	97%	65%	29.0%	0.7%	**23.3%**	**0.7%**	**-16%**	
91.1%	97%	70%	29.0%	0.7%	**24.2%**	**0.7%**	**-28%**	
91.1%	97%	75%	29.0%	0.7%	**25.1%**	**0.7%**	**-41%**	
91.1%	97%	80%	29.0%	0.7%	**26.0%**	**0.7%**	**-54%**	
91.1%	97%	85%	29.0%	0.7%	**26.9%**	**0.7%**	**-67%**	
91.1%	97%	90%	29.0%	0.7%	**27.7%**	**0.7%**	**-81%**	
91.1%	97%	95%	29.0%	0.7%	**28.6%**	**0.7%**	**-94%**	
91.1%	97%	97%	29.0%	0.7%	**29.0%**	**0.7%**	**-100%**	
91.1%	85%	60%	29.0%	0.7%	**23.9%**	**0.7%**	**-25%**	
91.1%	85%	65%	29.0%	0.7%	**24.9%**	**0.7%**	**-39%**	
91.1%	85%	70%	29.0%	0.7%	**25.9%**	**0.7%**	**-53%**	
91.1%	85%	75%	29.0%	0.7%	**27.0%**	**0.7%**	**-69%**	
91.1%	85%	80%	29.0%	0.7%	**28.0%**	**0.7%**	**-84%**	
91.1%	85%	85%	29.0%	0.7%	**29.0%**	**0.7%**	**-100%**	
3) Change Dr. Singer's demand model using linear demand function								
50.0%	100%	60%	29.0%	0.7%	**21.3%**	**0.7%**	**-45%**	
Combined Sensitivities: Change Dr. Singer's inputs for the pass-through rate, Google Play's actual and but-for market shares								
3.0%	85%	60%	29.0%	0.7%	**19.3%**	**0.7%**	**-96%**	
3.0%	85%	65%	29.0%	0.7%	**20.8%**	**0.7%**	**-97%**	
3.0%	85%	70%	29.0%	0.7%	**22.4%**	**0.7%**	**-97%**	
3.0%	85%	75%	29.0%	0.7%	**24.2%**	**0.7%**	**-98%**	
3.0%	85%	80%	29.0%	0.7%	**26.4%**	**0.7%**	**-99%**	
3.0%	85%	85%	29.0%	0.7%	**29.0%**	**0.7%**	**-100%**	

Notes:

[1] The 3% pass-through rate is based on my empirical estimation. See Exhibit 5.

[2] I replace Dr. Singer's original model inputs with those highlighted in blue and keep the other ones unchanged.

Source:

[1] Singer Report Production.

Exhibit 8b

Consumer Class Damages based on Dr. Singer's IAP Model

August 16, 2016 - May 31, 2022

Model Input					Calculation Output		
Pass-Through Rate	**Google Play Actual Market Share**	**Google Play But-for Market Share**	**But-for Competitor Suply Elasticity**	**Actual Take Rate**	**But-for Take Rate**	**% Change from Dr. Singer's Damages Estimate**	**Consumer Class Damages based on Dr. Singer's Model ($M)**
Singer Model Original							
91.1%	**97%**	**60%**	**4.38**	**30.5%**	**14.4%**	**0%**	**$6,995**
Sensitivities							
1) Change Dr. Singer's input for the pass-through rate							
3.0%	97%	60%	4.38	30.5%	**12.2%**	**-97%**	
2) Change Dr. Singer's inputs for Google Play's actual and but-for market shares							
91.1%	97%	65%	4.38	30.5%	**14.8%**	**-3%**	
91.1%	97%	70%	4.38	30.5%	**15.4%**	**-6%**	
91.1%	97%	75%	4.38	30.5%	**16.2%**	**-11%**	
91.1%	97%	80%	4.38	30.5%	**17.2%**	**-17%**	
91.1%	97%	85%	4.38	30.5%	**18.6%**	**-25%**	
91.1%	97%	90%	4.38	30.5%	**20.7%**	**-38%**	
91.1%	97%	95%	4.38	30.5%	**24.2%**	**-61%**	
91.1%	97%	97%	4.38	30.5%	**26.2%**	**-76%**	
91.1%	85%	60%	4.38	30.5%	**14.5%**	**-1%**	
91.1%	85%	65%	4.38	30.5%	**15.1%**	**-4%**	
91.1%	85%	70%	4.38	30.5%	**15.8%**	**-8%**	
91.1%	85%	75%	4.38	30.5%	**16.7%**	**-13%**	
91.1%	85%	80%	4.38	30.5%	**17.9%**	**-21%**	
91.1%	85%	85%	4.38	30.5%	**19.7%**	**-32%**	
3) Change Dr. Singer's demand model using linear demand function							
50.0%	97%	60%	4.38	30.5%	**14.9%**	**-50%**	
4) Change Dr. Singer's input for the but-for competitor supply elasticity							
91.1%	97%	60%	2.00	30.5%	**15.7%**	**-8%**	
91.1%	97%	60%	0.00	30.5%	**18.9%**	**-27%**	
Combined Sensitivities: Change Dr. Singer's inputs for the pass-through rate, Google Play's actual and but-for market shares, and the but-for competitor supply elasticity							
3.0%	85%	60%	0.00	30.5%	**18.6%**	**-98%**	**$146**
3.0%	85%	65%	0.00	30.5%	**20.1%**	**-98%**	**$126**
3.0%	85%	70%	0.00	30.5%	**21.8%**	**-99%**	**$103**
3.0%	85%	75%	0.00	30.5%	**23.8%**	**-99%**	**$75**
3.0%	85%	80%	0.00	30.5%	**26.3%**	**-99%**	**$41**
3.0%	85%	85%	0.00	30.5%	**29.4%**	**-100%**	**$0**

Notes:
[1] The 3% pass-through rate is based on my empirical estimation. See Exhibit 5.
[2] I replace Dr. Singer's original model inputs with those highlighted in blue and keep the other ones unchanged.

Source:
[1] Singer Report Production.

Exhibit 8c

Consumer Class Damages based on Dr. Singer's Combined Market Discount Model

August 16, 2016 - May 31, 2022

Model Input					Calculation Output			
Pass-Through Rate	**Google Play Actual Market Share**	**Google Play But-for Market Share**	**Actual Take Rate**	**Actual Consumer Subsidy as a Percent of Gross Consumer Spend**	**But-for Take Rate**	**But-for Consumer Subsidy as a Percent of Gross Consumer Spend**	**% Change from Dr. Singer's Damages Estimate**	**Consumer Class Damages based on Dr. Singer's Model ($M)**
Singer Model Original								
-	**100%**	**60%**	**30.5%**	**1.6%**	**30.5%**	**10.2%**	**0%**	**$3,924**
Sensitivities								
1) Change Dr. Singer's inputs for Google Play's actual and but-for market shares								
-	97%	60%	30.5%	1.6%	**30.5%**	**9.9%**	**-4%**	
-	97%	65%	30.5%	1.6%	**30.5%**	**8.8%**	**-16%**	
-	97%	70%	30.5%	1.6%	**30.5%**	**7.8%**	**-29%**	
-	97%	75%	30.5%	1.6%	**30.5%**	**6.7%**	**-41%**	
-	97%	80%	30.5%	1.6%	**30.5%**	**5.6%**	**-54%**	
-	97%	85%	30.5%	1.6%	**30.5%**	**4.4%**	**-67%**	
-	97%	90%	30.5%	1.6%	**30.5%**	**3.3%**	**-81%**	
-	97%	95%	30.5%	1.6%	**30.5%**	**2.1%**	**-94%**	
-	97%	97%	30.5%	1.6%	**30.5%**	**1.6%**	**-100%**	
-	85%	60%	30.5%	1.6%	**30.5%**	**8.1%**	**-25%**	
-	85%	65%	30.5%	1.6%	**30.5%**	**6.9%**	**-39%**	
-	85%	70%	30.5%	1.6%	**30.5%**	**5.6%**	**-54%**	
-	85%	75%	30.5%	1.6%	**30.5%**	**4.3%**	**-69%**	
-	85%	80%	30.5%	1.6%	**30.5%**	**3.0%**	**-84%**	
-	85%	85%	30.5%	1.6%	**30.5%**	**1.6%**	**-100%**	
2) Change Dr. Singer's demand model using linear demand function								
-	100%	60%	30.5%	1.6%	**30.5%**	**6.4%**	**-45%**	

Notes:

[1] I replace Dr. Singer's original model inputs with those highlighted in blue and keep the other ones unchanged.

Source:

[1] Singer Report Production.

Exhibit 8d

Consumer Class Damages based on Dr. Singer's Combined Market Take Rate Model

August 16, 2016 - May 31, 2022

Model Input					Calculation Output			
Pass-Through Rate	**Google Play Actual Market Share**	**Google Play But-for Market Share**	**Actual Take Rate**	**Actual Consumer Subsidy as a Percent of Gross Consumer Spend**	**But-for Take Rate**	**But-for Consumer Subsidy as a Percent of Gross Consumer Spend**	**% Change from Dr. Singer's Damages Estimate**	**Consumer Class Damages based on Dr. Singer's Model ($M)**
Singer Model Original								
91.1%	**100%**	**60%**	**30.5%**	**1.6%**	**23.4%**	**1.6%**	**0%**	**$3,656**
Sensitivities								
1) Change Dr. Singer's input for the pass-through rate								
3.0%	100%	60%	30.5%	1.6%	**18.5%**	**1.6%**	**-96%**	
2) Change Dr. Singer's inputs for Google Play's actual and but-for market shares								
91.1%	97%	60%	30.5%	1.6%	**23.8%**	**1.6%**	**-4%**	
91.1%	97%	65%	30.5%	1.6%	**24.7%**	**1.6%**	**-16%**	
91.1%	97%	70%	30.5%	1.6%	**25.6%**	**1.6%**	**-28%**	
91.1%	97%	75%	30.5%	1.6%	**26.5%**	**1.6%**	**-41%**	
91.1%	97%	80%	30.5%	1.6%	**27.4%**	**1.6%**	**-54%**	
91.1%	97%	85%	30.5%	1.6%	**28.3%**	**1.6%**	**-67%**	
91.1%	97%	90%	30.5%	1.6%	**29.2%**	**1.6%**	**-80%**	
91.1%	97%	95%	30.5%	1.6%	**30.1%**	**1.6%**	**-94%**	
91.1%	97%	97%	30.5%	1.6%	**30.5%**	**1.6%**	**-100%**	
91.1%	85%	60%	30.5%	1.6%	**25.3%**	**1.6%**	**-25%**	
91.1%	85%	65%	30.5%	1.6%	**26.3%**	**1.6%**	**-39%**	
91.1%	85%	70%	30.5%	1.6%	**27.4%**	**1.6%**	**-53%**	
91.1%	85%	75%	30.5%	1.6%	**28.4%**	**1.6%**	**-69%**	
91.1%	85%	80%	30.5%	1.6%	**29.4%**	**1.6%**	**-84%**	
91.1%	85%	85%	30.5%	1.6%	**30.5%**	**1.6%**	**-100%**	
3) Change Dr. Singer's demand model using linear demand function								
50.0%	100%	60%	30.5%	1.6%	**22.7%**	**1.6%**	**-46%**	
Combined Sensitivities: Change Dr. Singer's inputs for the pass-through rate, Google Play's actual and but-for market shares								
3.0%	85%	60%	30.5%	1.6%	**20.7%**	**1.6%**	**-96%**	**$134**
3.0%	85%	65%	30.5%	1.6%	**22.1%**	**1.6%**	**-97%**	**$114**
3.0%	85%	70%	30.5%	1.6%	**23.8%**	**1.6%**	**-97%**	**$92**
3.0%	85%	75%	30.5%	1.6%	**25.7%**	**1.6%**	**-98%**	**$66**
3.0%	85%	80%	30.5%	1.6%	**27.9%**	**1.6%**	**-99%**	**$36**
3.0%	85%	85%	30.5%	1.6%	**30.5%**	**1.6%**	**-100%**	**$0**

Notes:

[1] The 3% pass-through rate is based on my empirical estimation. See Exhibit 5.

[2] I replace Dr. Singer's original model inputs with those highlighted in blue and keep the other ones unchanged.

Source:

[1] Singer Report Production.

Exhibit 8e

Consumer Class Damages based on Dr. Singer's Combined Market Hybrid Model

August 16, 2016 - May 31, 2022

Model Input					Calculation Output			
Pass-Through Rate	**Google Play Actual Market Share**	**Google Play But-for Market Share**	**Actual Take Rate**	**Actual Consumer Subsidy as a Percent of Gross Consumer Spend**	**But-for Take Rate**	**But-for Consumer Subsidy as a Percent of Gross Consumer Spend**	**% Change from Dr. Singer's Damages Estimate**	**Consumer Class Damages based on Dr. Singer's Model ($M)**
Singer Model Original								
91.1%	**100%**	**60%**	**30.5%**	**1.6%**	**28.6%**	**7.9%**	**0%**	**$3,809**
Sensitivities								
1) Change Dr. Singer's input for pass-through rate								
3.0%	100%	60%	30.5%	1.6%	**28.5%**	**8.0%**	**-23%**	
2) Change Dr. Singer's inputs for Google Play's actual and but-for market shares								
91.1%	97%	60%	30.5%	1.6%	**28.7%**	**7.5%**	**-4%**	
91.1%	97%	65%	30.5%	1.6%	**28.9%**	**6.8%**	**-16%**	
91.1%	97%	70%	30.5%	1.6%	**29.1%**	**6.0%**	**-29%**	
91.1%	97%	75%	30.5%	1.6%	**29.4%**	**5.2%**	**-41%**	
91.1%	97%	80%	30.5%	1.6%	**29.6%**	**4.4%**	**-54%**	
91.1%	97%	85%	30.5%	1.6%	**29.9%**	**3.6%**	**-67%**	
91.1%	97%	90%	30.5%	1.6%	**30.1%**	**2.8%**	**-81%**	
91.1%	97%	95%	30.5%	1.6%	**30.4%**	**2.0%**	**-94%**	
91.1%	97%	97%	30.5%	1.6%	**30.5%**	**1.6%**	**-100%**	
91.1%	85%	60%	30.5%	1.6%	**29.1%**	**6.2%**	**-25%**	
91.1%	85%	65%	30.5%	1.6%	**29.3%**	**5.3%**	**-39%**	
91.1%	85%	70%	30.5%	1.6%	**29.6%**	**4.4%**	**-54%**	
91.1%	85%	75%	30.5%	1.6%	**29.9%**	**3.5%**	**-69%**	
91.1%	85%	80%	30.5%	1.6%	**30.2%**	**2.6%**	**-84%**	
91.1%	85%	85%	30.5%	1.6%	**30.5%**	**1.6%**	**-100%**	
3) Change Dr. Singer's demand model using linear demand function								
50.0%	100%	60%	30.5%	1.6%	**42.6%**	**17.5%**	**14%**	
Combined Sensitivities: Change Dr. Singer's inputs for the pass-through rate, Google Play's actual and but-for market shares								
3.0%	85%	60%	30.5%	1.6%	**29.0%**	**6.4%**	**-42%**	**$2,191**
3.0%	85%	65%	30.5%	1.6%	**29.3%**	**5.5%**	**-54%**	**$1,770**
3.0%	85%	70%	30.5%	1.6%	**29.6%**	**4.5%**	**-65%**	**$1,341**
3.0%	85%	75%	30.5%	1.6%	**29.9%**	**3.6%**	**-76%**	**$903**
3.0%	85%	80%	30.5%	1.6%	**30.2%**	**2.6%**	**-88%**	**$456**
3.0%	85%	85%	30.5%	1.6%	**30.5%**	**1.6%**	**-100%**	**$0**

Notes:

[1] The 3% pass-through rate is based on my empirical estimation. See Exhibit 5.

[2] I replace Dr. Singer's original model inputs with those highlighted in blue and keep the other ones unchanged.

Source:

[1] Singer Report Production.

Exhibit 9a

Prices of Paid Downloads Transacted in May 2022 - Games

[redacted]

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 9b

Prices of Paid Downloads Transacted in May 2022 - Non-Games

[redacted]

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 10a

Prices of IAPs and Subscriptions Transacted in May 2022 - Games

[redacted]

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 10b

Prices of IAPs and Subscriptions Transacted in May 2022 - Non-Games

[redacted]

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 11a

Quantity Sales of Paid Apps Transacted in May 2022 - Games

[redacted]

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 11b

Quantity Sales of Paid Apps Transacted in May 2022 - Non-Games

[redacted]

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 12

Monthly Hours Spent on Apps

[redacted]

Source:

[1] App Annie data produced in response to Consumers' June 2, 2021 subpoena.

Exhibit 13

Total Hours Spent on Selected Apps in September 2021

[redacted]

Note:
[1] The total hours spent are based on the total user usage hours for each app in September 2021.

Source:
[1] App Annie data produced in response to Consumers' June 2, 2021 subpoena.

Exhibit 14

Share of Consumer Spend from the Samsung Galaxy Store of Total Consumer Spend from Google Play and Samsung Galaxy Store on Samsung Devices in the U.S.

[redacted]

Sources:
[1] SEA_GOOGLE_00000720; GOOG-PLAY-005535886.

Exhibit 15a

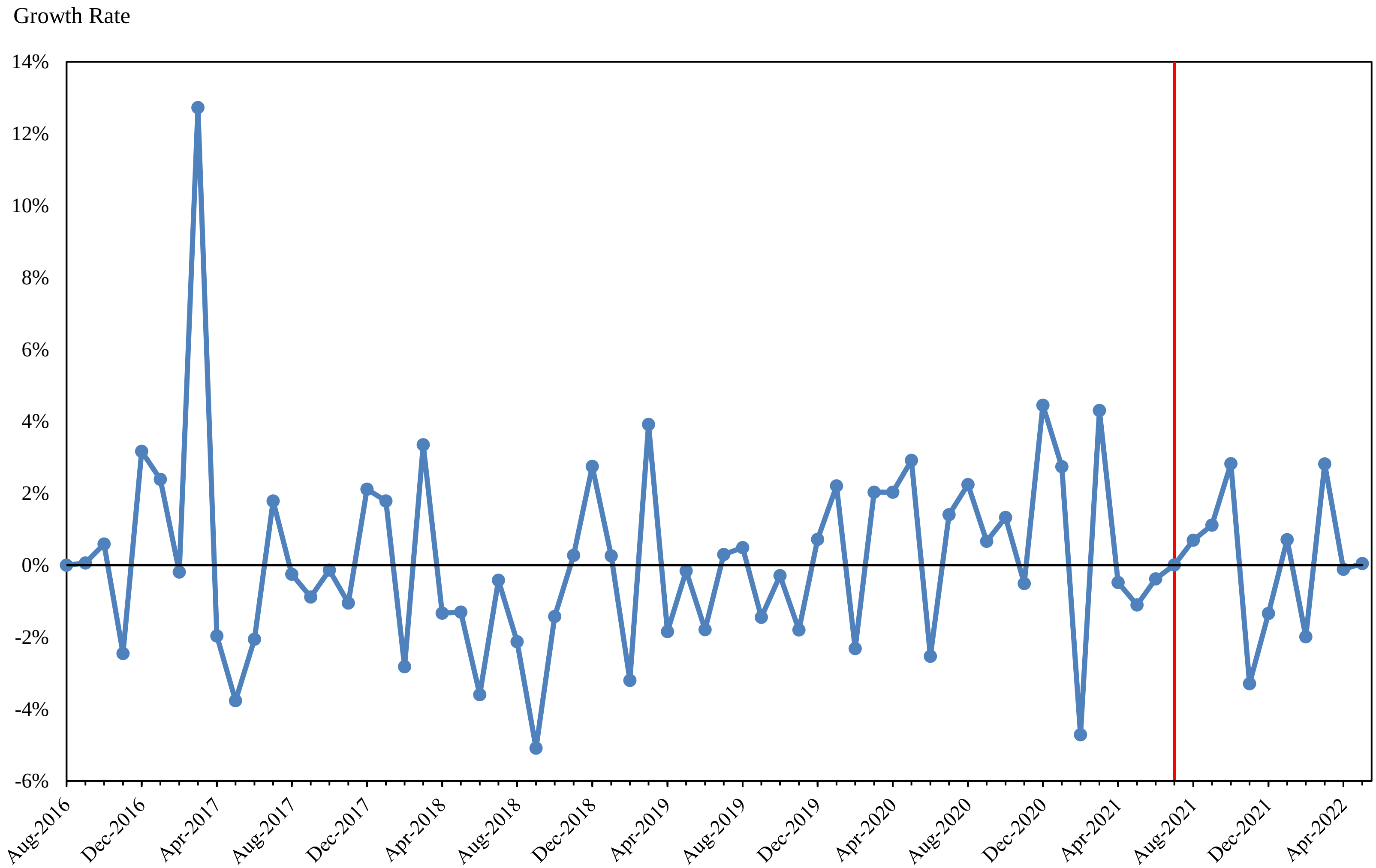
Monthly Total Number of Apps with Non-Zero Sales

[redacted]

Source:
[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 15b

Growth Rate of the Monthly Total Number of Apps with Non-Zero Sales



Note:
[1] Growth rate is calculated as the percentage change of monthly total number of apps with non-zero sales from the previous month.

Source:
[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 16

Service Fee Rate Benchmarks Proposed by Dr. Singer and Dr. Rysman

App Distribution

Category	Benchmark	Service Fee Rate	Proposed by Dr. Singer	Proposed by Dr. Rysman
Alternative Android App Stores	ONE Store	5-20%	Yes	Yes
	Aptoide	10-25%	Yes	Yes
	Amazon Appstore	18%	Yes	Yes
	Galaxy Store	30%	No	Yes
	Game Jolt Store (Mobile)	0 to 10%	No	Yes
PC App Stores	Microsoft	5% for non-game and non-Xbox apps 0% for non-game PC apps if apps utilize its own or a 3P payment system	Yes	Yes
	Chrome Web Store	5% if using Chrome Web Store API 30% for in-app payments for ARC apps	Yes	Yes
	Game Jolt Store	0-10%	No	Yes
PC Game Platforms	Microsoft (Game)	12% for PC games 30% for Xbox console games [1]	Yes	Yes
	Steam	20-30%	Yes	Yes
	Epic Games Store	12% for all games	Yes	Yes
	Discord	10%	Yes	Yes
Other Two-Sided Platforms	Substack (Online publishing platform)	10% + credit card fee	Yes	No
	Revue (Online publishing platform)	5%	Yes	No
	Amazon	8%-15% + $0.99/item or $39.99/month	Yes	No
	eBay	12.55% + $0.35	Yes	No
	Etsy	8% + $0.45	Yes	No

Note:

[1] Xbox is listed in relation to the Microsoft Store in Rysman Exhibit 68.

Sources:

[1] Rysman Report Exhibits 68 - 69; ¶¶ 477.

[2] Singer Report Table 7; ¶¶ 314.

Exhibit 17

Summary of Selected Online Platform Service Fees

With Service Fee Rates At or Above 30%

Platform Type	Platform	Service Fee Rate	Notes
Game Console Store	Microsoft Store for Xbox	30%	15% for non-video game subscriptions. 15% for non-Xbox purchases (except certain Business, Education, and Games apps on Windows 8).
	Nintendo E-Shop	30%	
	PlayStation Store	30%	
PC Gaming Store	Steam	30%	25% for sales between $10 million and $50 million. 20% for sales greater than $50 million.
Mobile App Store	Samsung Galaxy Store	30%	
	Amazon Appstore	30%	20% for app developers with less than $1 million in app revenue, plus 10% of revenue as credit for AWS.
Book and Audiobook Publishing	Audible-ACX	60% or 75%	Commission rates are increased for audiobooks which are not exclusively distributed.
	Kindle Direct Publishing	30% or 65%	Kindle Direct publishers may choose between a "35% Royalty Option" and a "70% Royalty Option."

Sources:

[1] "Terms and Conditions," Samsung Galaxy Store Seller Portal, https://seller.samsungapps.com/help/termsAndConditions.as.
[2] "Coming soon: Amazon Appstore Small Business Accelerator Program," Amazon Appstore, June 15, 2021, https://developer.amazon.com/apps-and-games/blogs/2021/06/small-business-accelerator-program.
[3] "Amazon's Appstore lowers its cut of developer revenue for small businesses, adds AWS credits," Tech Crunch, June 17, 2021, https://www.techcrunch.com/2021/06/17/amazons-appstore-lowers-its-cut-of-developer-revenue-for-small-businesses-adds-aws-credits/
[4] "Production Earnings and Costs," ACX, https://www.acx.com/help/what-s-the-deal/200497690.
[5] "eBook Royalties," Kindle Direct Publishing, https://kdp.amazon.com/en_US/help/topic/G200644210.
[6] Borck, Caminade, and Wartburg, "Apple's App Store and Other Digital Marketplaces," Analysis Group, July 22, 2020.

Exhibit 18

Monthly Consumer Class Damages
From Changes in the Service Fee Rate (USD)

Year	Month	Consumer Damages from Overcharge
2016	8.16 - 8.31	[redacted]
2016	9	
2016	10	
2016	11	
2016	12	
2017	1	
2017	2	
2017	3	
2017	4	
2017	5	
2017	6	
2017	7	
2017	8	
2017	9	
2017	10	
2017	11	
2017	12	
2018	1	
2018	2	
2018	3	
2018	4	
2018	5	
2018	6	
2018	7	
2018	8	
2018	9	
2018	10	
2018	11	
2018	12	
2019	1	
2019	2	
2019	3	
2019	4	
2019	5	
2019	6	
2019	7	
2019	8	
2019	9	
2019	10	
2019	11	
2019	12	

Exhibit 18

Monthly Consumer Class Damages
From Changes in the Service Fee Rate (USD)

Year	Month	Consumer Damages from Overcharge
2020	1	[redacted]
2020	2	
2020	3	
2020	4	
2020	5	
2020	6	
2020	7	
2020	8	
2020	9	
2020	10	
2020	11	
2020	12	
2021	1	
2021	2	
2021	3	
2021	4	
2021	5	
2021	6	
2021	7	
2021	8	
2021	9	
2021	10	
2021	11	
2021	12	
2022	1	
2022	2	
2022	3	
2022	4	
2022	5	
September 1, 2018 - May 31, 2022		
August 16, 2016 - May 31, 2022		

Notes:

[1] But-for service fee rate is calculated based on the period of January 2022 - May 2022, and then applied to the corresponding starting time point till December 2021.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 19

Monthly Consumer Class Damages
From Changes in Consumer Subsidies (USD)

Year	Month	Consumer Damages from Play Points	Consumer Damages from Non-Points Google Discounts	Consumer Damages (Combined)
2016	8.16 - 8.31	[redacted]		
2016	9			
2016	10			
2016	11			
2016	12			
2017	1			
2017	2			
2017	3			
2017	4			
2017	5			
2017	6			
2017	7			
2017	8			
2017	9			
2017	10			
2017	11			
2017	12			
2018	1			
2018	2			
2018	3			
2018	4			
2018	5			
2018	6			
2018	7			
2018	8			
2018	9			
2018	10			
2018	11			
2018	12			
2019	1			
2019	2			
2019	3			
2019	4			
2019	5			
2019	6			
2019	7			
2019	8			
2019	9			
2019	10			
2019	11			
2019	12			

Exhibit 19

Monthly Consumer Class Damages
From Changes in Consumer Subsidies (USD)

Year	Month	Consumer Damages from Play Points	Consumer Damages from Non-Points Google Discounts	Consumer Damages (Combined)
2020	1	[redacted]		
2020	2			
2020	3			
2020	4			
2020	5			
2020	6			
2020	7			
2020	8			
2020	9			
2020	10			
2020	11			
2020	12			
2021	1			
2021	2			
2021	3			
2021	4			
2021	5			
2021	6			
2021	7			
2021	8			
2021	9			
2021	10			
2021	11			
2021	12			
2022	1			
2022	2			
2022	3			
2022	4			
2022	5			
September 1, 2018 - May 31, 2022				
August 16, 2016 - May 31, 2022				

Notes:

[1] But-for Play Points rate and but-for Google offered non-Points discount rate are calculated based on the period of November 4, 2019 - May 31, 2022, and then applied to the corresponding starting time point till November 3, 2019.

[2] Consumer damages in November 2019 from changes in consumer subsidies (Play Points and non-Points discounts) are for the period of November 1, 2019 - November 3, 2019 before the Play Points program launched in the U.S.

[2] The amount of Play Points offered is adjusted downward by 3% when calculating the actual and but-for Points discount rates to account for Points expiration.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 20

Service Fee Rates of Top Android Mobile App Stores in China

App Store	Service Fee Rate	Effective Service Fee Rate
Huawei Mobile App Store [1]	▪ **Channel fee**: 2% (as of March 1, 2022)	
	▪ **Paid downloads**: 30%	(1-2%) x 30% + 2% = 31.4%
	▪ **IAPs or digital content purchases (subscriptions included)**: 50% for games, 30% for other categories, 20% for education apps	Games: 51%; other: 31.4%; education apps: 21.6%
	▪ **Paid downloads**: 20% for education apps (as of December 1, 2019)	(1-2%) x 20% + 2% = 21.6%
Tencent Mobile App Store [2]	▪ **Channel fee**: 25%	
	▪ **Game apps (joint operation)**: 40%	(1-25%) x 40% + 25% = 55%
	▪ **Historical tiered rates for game apps (as of 2014):** 30% for game apps under "open access" operating mode and 40% for game apps under "joint operation" operating mode	47.5% for game apps under "open access" operating mode and 55% or game apps under "joint operation" operating mode
	▪ **Historical tiered rates (as of 2012):** 0% of monthly revenue amount below ¥100,000, 30% of monthly revenue between ¥100,000 to ¥1,000,000, and 50% of monthly revenue between ¥1,000,000 to ¥10,000,000.	Tiered rates: 25%, 47.5%, 62.5%
OPPO Mobile App Store [3]	▪ **Channel fee**: 5%	
	▪ **Game apps (joint operation)**: 50%	(1-5%) x 50% + 5% = 52.5%
	▪ **Game apps**: Tiered rates of 0% of monthly revenue amount below ¥100,000, 30% of amount between ¥100,000 to ¥500,000, and 50% of amount over ¥500,000	Tiered rates: 5%, 33.5%, 52.5%
Vivo Mobile App Store [4]	▪ **Channel fee**: 5%	
	▪ **Game Apps (joint operation)**: 50%	(1-5%) x 50% + 5% = 52.5%
	▪ **Game Apps ("Independent Game Spark Plan" as of June 2018)**: Tiered rates of 0% of monthly revenue amount below ¥100,000, 30% of amount between ¥100,000 to ¥500,000, and 50% of amount over ¥500,000.	Tiered rates: 5%, 33.5%, 52.5%
Xiaomi Mobile App Store [5]	▪ **Channel fee**: 5%	
	▪ **Game apps**: 50%	(1-5%) x 50% + 5% = 52.5%
	▪ **Game apps (tablet games)**: 30% (as of August 2015)	(1-5%) x 30% + 5% = 33.5%
360 Mobile App Store [6]	▪ **Channel fee**: 20%	
	▪ **Game Apps**: Tiered rate structure of 0% of monthly revenue amount below ¥100,000, 25% of monthly revenue amount between ¥100,000 to ¥1,000,000, 50% of monthly revenue amount between ¥1,000,000 to ¥5,000,000, and 55% of monthly revenue amount over ¥5,000,000	Tiered rates: (1-20%) x 0% + 20% = 20% (1-20%) x 25% + 20% = 40% (1-20%) x 50% + 20% = 60% (1-20%) x 55% + 20% = 64%
Baidu Mobile App Store [7]	▪ **Channel fee**: 5%	
	▪ **Game Apps (Q Coin, for IAP)**: Tiered rate structure of 30% of monthly revenue amount below ¥500,000 and 50% of monthly revenue amount over ¥500,000.	Tiered rates: (1-5%) x 30% + 5% = 33.5% (1-5%) x 50% + 5% = 52.5%
WeChat mini-program [8]	▪ **Game Apps IAP**: 40% for regular games and 30% for "innovative" games	40% or 30%
ByteDance mini-program [9]	▪ **Channel fee**: 5%	
	▪ **Game Apps IAP**: Tiered rate structure of 40% of monthly revenue amount below ¥500,000 and 30% of monthly revenue amount over ¥500,000.	Tiered rates: (1-5%) x 40% + 5% = 43% (1-5%) x 30% + 5% = 33.5%

Notes:

[1] Huawei mobile app store service fee rate: "AppGallery Joint Operations Service Agreement," January 26, 2022, https://terms-drcn.platform.dbankcloud.cn/agreementservice/developer/getAgreementTemplate?agrType=1005&country=cn&language=zh_cn&version=2022012602. See an earlier February 23, 2020 version in English at https://developer.huawei.com/consumer/en/doc/30203#h1-1582512387270.
Payment channel fee rate: "HUAWEI Developer Merchant Service Agreement," https://developer.huawei.com/consumer/en/doc/start/merchantserviceagreement-0000001052848245#EN-US_TOPIC_0000001052848245__section17986481491; "Deductions for Payment Channels," https://developer.huawei.com/consumer/en/doc/00002.

[2] Tencent mobile app store service fee rates for joint operation game apps: https://wikinew.open.qq.com/#/iwiki/813395318.
Tencent mobile app store historical tiered service fee rates for game apps (as of 2014): http://it.people.com.cn/n/2014/0307/c1009-24555378.html.
Tencent mobile app store historical tiered service fee rates for game apps (as of 2012): http://news.cntv.cn/20120107/109143.shtml.

[3] OPPO mobile app store service fee rates for joint operation game apps: https://open.oppomobile.com/new/developmentDoc/info?id=10987.

[4] Vivo mobile app store service fee rates for joint operation game apps: https://dev.vivo.com.cn/documentCenter/doc/251.
Vivo mobile app store "Independent Game Spark Plan" as of June 2018: https://dev.vivo.com.cn/activityPage/21.

[5] Xiaomi mobile app store service fee rates for game apps: https://dev.mi.com/console/doc/detail?pId=729.
Xiaomi mobile app store service fee rates for tablet and TV games: https://www.leiphone.com/category/zixun/xCKPRyPmX3Hf2fZN.html.

[6] 360 mobile app store service fee rates for game apps: http://opengame.360.cn/wiki/8.

[7] Baidu mobile app store service fee rates: http://dev.mgame.baidu.com/yyjr/js.

[8] Mini-program games are games to be played without downloading the app. Hence all sales are from in-app purchases.
WeChat mini-program service fee rates for games: https://developers.weixin.qq.com/community/minigame/doc/000caa83cbcc30717f5dea01f5b408.

[9] Mini-program games are games to be played without downloading the app. Hence all sales are from in-app purchases.
https://microapp.bytedance.com/docs/zh-CN/mini-game/operation/game-revenue/mini-game-revenue-sharing-clause/.

Exhibit 21

Restitution From Changes in the Service Fee Rate (in Millions USD)

Description	Calculation	Profits-Based Restitution	Revenue-Based Restitution	Source
Actual Google Play Apps & Games Revenue	[A]	[redacted]	[redacted]	Solomon Report, Schedule 5
Actual Service Fee Rate	*[1]*	29%	29%	Google Play Transactions Data
But-for Service Fee Rate	*[2]*	26%	26%	Estimated, See Section XI.A
Actual Play Points %	*[3]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Play Points %	*[4]*	[redacted]	[redacted]	Same as Actual
Actual Google Discount %	*[5]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Google Discount %	*[6]*	[redacted]	[redacted]	Same as Actual
Pass-through Rate	*[7]*	3.0%	3.0%	Empirical Estimate, See Exhibit 5
Percentage Reduction in Per-Unit Apps & Games Revenue	[B]	10.4%	10.4%	Calculated based on [1] - [7]
But-For Google Play App & Game Revenue	[C] = [A]*(1-[B])	[redacted]	[redacted]	Calculated
Actual Google Play Other Revenue	[D]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Google Play Revenue	[E] = [C]+[D]	[redacted]	[redacted]	Calculated
Actual Google Play Operating Profit Margin for App & Games	[F]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Google Play App & Games Costs	[G] = [C]*(1-[F])	[redacted]	[redacted]	Calculated
Actual Google Play Other Costs	[H]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-for Total Google Play Costs	[I] = [G]+[H]	[redacted]	[redacted]	Calculated
But-For Incremental Profits	[J] = [E]-[I]	[redacted]	[redacted]	Calculated
Actual Incremental Profits	[K]	[redacted]	[redacted]	Solomon Report, Schedule 2
Excess Profits	[L.1] = [K]-[J]	[redacted]	[redacted]	Calculated
Consumer Savings	[L.2] = [A]-[E]	[redacted]	[redacted]	Calculated
Pass-through Rate	[M]	[redacted]	[redacted]	Empirical Estimate, See Exhibit 5
Consumer Restitution (Worldwide)	[L]*[M]	[redacted]	[redacted]	**Calculated**
Geographic Area		[redacted]	[redacted]	
US	Allocated	[redacted]	[redacted]	
39 States	Allocated	[redacted]	[redacted]	
1 Alaska	Allocated	[redacted]	[redacted]	
2 Arizona	Allocated	[redacted]	[redacted]	
3 Arkansas	Allocated	[redacted]	[redacted]	
4 California	Allocated	[redacted]	[redacted]	
5 Colorado	Allocated	[redacted]	[redacted]	
6 Connecticut	Allocated	[redacted]	[redacted]	
7 Delaware	Allocated	[redacted]	[redacted]	
8 District of Columbia	Allocated	[redacted]	[redacted]	
9 Florida	Allocated	[redacted]	[redacted]	
10 Idaho	Allocated	[redacted]	[redacted]	
11 Indiana	Allocated	[redacted]	[redacted]	
12 Iowa	Allocated	[redacted]	[redacted]	
13 Kentucky	Allocated	[redacted]	[redacted]	
14 Louisiana	Allocated	[redacted]	[redacted]	
15 Maryland	Allocated	[redacted]	[redacted]	
16 Massachusetts	Allocated	[redacted]	[redacted]	
17 Minnesota	Allocated	[redacted]	[redacted]	
18 Mississippi	Allocated	[redacted]	[redacted]	
19 Missouri	Allocated	[redacted]	[redacted]	
20 Montana	Allocated	[redacted]	[redacted]	
21 Nebraska	Allocated	[redacted]	[redacted]	
22 Nevada	Allocated	[redacted]	[redacted]	
23 New Hampshire	Allocated	[redacted]	[redacted]	
24 New Jersey	Allocated	[redacted]	[redacted]	
25 New Mexico	Allocated	[redacted]	[redacted]	
26 New York	Allocated	[redacted]	[redacted]	
27 North Carolina	Allocated	[redacted]	[redacted]	
28 North Dakota	Allocated	[redacted]	[redacted]	
29 Oklahoma	Allocated	[redacted]	[redacted]	
30 Oregon	Allocated	[redacted]	[redacted]	
31 Rhode Island	Allocated	[redacted]	[redacted]	
32 South Dakota	Allocated	[redacted]	[redacted]	
33 Tennessee	Allocated	[redacted]	[redacted]	
34 Texas	Allocated	[redacted]	[redacted]	
35 Utah	Allocated	[redacted]	[redacted]	
36 Vermont	Allocated	[redacted]	[redacted]	
37 Virginia	Allocated	[redacted]	[redacted]	
38 Washington	Allocated	[redacted]	[redacted]	
39 West Virginia	Allocated	[redacted]	[redacted]	

Notes:

[1] Worldwide restitution is allocated to the US and the plaintiff states using weights from Solomon Schedule 60 (Summary of Pre-Tax Sales Revenue Distributed to Google by Geographic Area in the US, 2011 - 2021) and Schedule 61 (Pro-Rata of Pre-Tax Sales Revenue Distributed to Google by Geographic Area in the US).

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 22

Restitution From Changes in the Consumer Subsidy (in Millions USD)

Description	Calculation	Profits-Based Restitution	Revenue-Based Restitution	Source
Actual Google Play Store Consumer Spend	[A]	[redacted]	[redacted]	Solomon Report, Schedule 4
Actual Service Fee Rate	*[1]*	29%	29%	Google Play Transactions Data
But-for Service Fee Rate	*[2]*	29%	29%	Same as Actual
Actual Play Points %	*[3]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Play Points %	*[4]*	[redacted]	[redacted]	Estimated, See Section XI.B
Actual Google Discount %	*[5]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Google Discount %	*[6]*	[redacted]	[redacted]	Estimated, See Section XI.B
Actual Developer Discount	*[7]*	[redacted]	[redacted]	Google Play Transactions Data
Percentage Reduction in Per-Unit Consumer Spend	[B]	[redacted]	[redacted]	Calculated based on [1] - [7]
Reduction in App & Games Revenue	[A]*[B]	[redacted]	[redacted]	Calculated
Actual Google Play Apps & Games Revenue	[C]	[redacted]	[redacted]	Solomon Report, Schedule 5
Actual Google Play Other Revenue	[D]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Google Play Revenue	[E] = [C]-[A]*[B]+[D]	[redacted]	[redacted]	Calculated
Actual Google Play Operating Profit Margin for App & Games	[F]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Google Play App & Games Costs	[G]=([C]-[A]*[B])*(1-[F])	[redacted]	[redacted]	Calculated
Actual Google Play Other Costs	[H]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-for Total Google Play Costs	[I] = [G]+[H]	[redacted]	[redacted]	Calculated
But-For Incremental Profits	[J] = [E]-[I]	[redacted]	[redacted]	Calculated
Actual Incremental Profits	[K]	[redacted]	[redacted]	Solomon Report, Schedule 2
Excess Profits	[L.1] = [K]-[J]	[redacted]	[redacted]	Calculated
Consumer Savings	[L.2] = [C]-[E]	[redacted]	[redacted]	Calculated
Pass-through Rate	[M]	[redacted]	[redacted]	
Consumer Restitution (Worldwide)	[L]*[M]	[redacted]	[redacted]	**Calculated**
Geographic Area		[redacted]	[redacted]	
US	Allocated	[redacted]	[redacted]	
39 States	Allocated	[redacted]	[redacted]	
1 Alaska	Allocated	[redacted]	[redacted]	
2 Arizona	Allocated	[redacted]	[redacted]	
3 Arkansas	Allocated	[redacted]	[redacted]	
4 California	Allocated	[redacted]	[redacted]	
5 Colorado	Allocated	[redacted]	[redacted]	
6 Connecticut	Allocated	[redacted]	[redacted]	
7 Delaware	Allocated	[redacted]	[redacted]	
8 District of Columbia	Allocated	[redacted]	[redacted]	
9 Florida	Allocated	[redacted]	[redacted]	
10 Idaho	Allocated	[redacted]	[redacted]	
11 Indiana	Allocated	[redacted]	[redacted]	
12 Iowa	Allocated	[redacted]	[redacted]	
13 Kentucky	Allocated	[redacted]	[redacted]	
14 Louisiana	Allocated	[redacted]	[redacted]	
15 Maryland	Allocated	[redacted]	[redacted]	
16 Massachusetts	Allocated	[redacted]	[redacted]	
17 Minnesota	Allocated	[redacted]	[redacted]	
18 Mississippi	Allocated	[redacted]	[redacted]	
19 Missouri	Allocated	[redacted]	[redacted]	
20 Montana	Allocated	[redacted]	[redacted]	
21 Nebraska	Allocated	[redacted]	[redacted]	
22 Nevada	Allocated	[redacted]	[redacted]	
23 New Hampshire	Allocated	[redacted]	[redacted]	
24 New Jersey	Allocated	[redacted]	[redacted]	
25 New Mexico	Allocated	[redacted]	[redacted]	
26 New York	Allocated	[redacted]	[redacted]	
27 North Carolina	Allocated	[redacted]	[redacted]	
28 North Dakota	Allocated	[redacted]	[redacted]	
29 Oklahoma	Allocated	[redacted]	[redacted]	
30 Oregon	Allocated	[redacted]	[redacted]	
31 Rhode Island	Allocated	[redacted]	[redacted]	
32 South Dakota	Allocated	[redacted]	[redacted]	
33 Tennessee	Allocated	[redacted]	[redacted]	
34 Texas	Allocated	[redacted]	[redacted]	
35 Utah	Allocated	[redacted]	[redacted]	
36 Vermont	Allocated	[redacted]	[redacted]	
37 Virginia	Allocated	[redacted]	[redacted]	
38 Washington	Allocated	[redacted]	[redacted]	
39 West Virginia	Allocated	[redacted]	[redacted]	

Notes:

[1] Worldwide restitution is allocated to the US and the plaintiff states using weights from Solomon Schedule 60 (Summary of Pre-Tax Sales Revenue Distributed to Google by Geographic Area in the US, 2011 - 2021) and Schedule 61 (Pro-Rata of Pre-Tax Sales Revenue Distributed to Google by Geographic Area in the US).

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 23

Disgorgement From Changes in the Service Fee Rate (in Millions USD)

Description	Calculation	Calculation 1 (ONE Store-Based But-for Market Share)	Calculation 2 (But-for Market Share Same as Actual)	Source
Actual Google Play Apps & Games Revenue	[A]	[redacted]	[redacted]	Solomon Report, Schedule 5
Actual Service Fee Rate	*[1]*	*29%*	*29%*	Google Play Transactions Data
But-for Service Fee Rate	*[2]*	*26%*	*26%*	Estimated, See Section XI. A
Actual Play Points %	*[3]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Play Points %	*[4]*			Same as Actual
Actual Google Discount %	*[5]*			Google Play Transactions Data
But-for Google Discount %	*[6]*			Same as Actual
Pass-through Rate	*[7]*	*3.0%*	*3.0%*	Empirical Estimate, See Exhibit 5
Percentage Reduction in Per-Unit Apps & Games Revenue	[B]	10.4%	10.4%	Calculated based on [1] - [7]
Subtotal	[C] = [A]*(1-[B])	[redacted]	[redacted]	Calculated
Demand Elasticity	*[8]*	*1.46*	*1.46*	Singer Merits Report, Table 8
Increase in Market Sales Quantity	[D]	0.1%	0.1%	Calculated based on [1] - [2], [8]
But-For Market App & Game Revenue	[E] = [C]*(1+[D])	[redacted]	[redacted]	Calculated
Actual Market Share	[F]	85.9%	85.9%	Singer Merits Report, ¶122
But-For Market Share	[G]	73.0%	85.9%	Empirical Evidence/Assumption
But-For Google Play App & Game Revenue	[H] = [E]/[F]*[G]	[redacted]	[redacted]	Calculated
Actual Google Play Other Revenue	[I]			Solomon Report, Schedule 5
But-for Google Play Total Revenue	[J] = [H]+[I]			Calculated
Actual Google Play Operating Profit Margin for App & Games	[K]			Solomon Report, Schedule 5
But-For Google Play App & Games Costs	[L] = [H]*(1-[K])			Calculated
Actual Google Play Other Costs	[M]			Solomon Report, Schedule 5
But-for Total Google Play Costs	[N] = [L]+[M]			Calculated
But-For Incremental Profits	[O] = [J]-[N]			Calculated
Actual Incremental Profits	[P]			Solomon Report, Schedule 2
Disgorgement (Worldwide)	[P] - [O]			**Calculated**
Geographic Area				
US	Allocated			
39 States	Allocated			
1 Alaska	Allocated			
2 Arizona	Allocated			
3 Arkansas	Allocated			
4 California	Allocated			
5 Colorado	Allocated			
6 Connecticut	Allocated			
7 Delaware	Allocated			
8 District of Columbia	Allocated			
9 Florida	Allocated			
10 Idaho	Allocated			
11 Indiana	Allocated			
12 Iowa	Allocated			
13 Kentucky	Allocated			
14 Louisiana	Allocated			
15 Maryland	Allocated			
16 Massachusetts	Allocated			
17 Minnesota	Allocated			
18 Mississippi	Allocated			
19 Missouri	Allocated			
20 Montana	Allocated			
21 Nebraska	Allocated			
22 Nevada	Allocated			
23 New Hampshire	Allocated			
24 New Jersey	Allocated			
25 New Mexico	Allocated			
26 New York	Allocated			
27 North Carolina	Allocated			
28 North Dakota	Allocated			
29 Oklahoma	Allocated			
30 Oregon	Allocated			
31 Rhode Island	Allocated			
32 South Dakota	Allocated			
33 Tennessee	Allocated			
34 Texas	Allocated			
35 Utah	Allocated			
36 Vermont	Allocated			
37 Virginia	Allocated			
38 Washington	Allocated			
39 West Virginia	Allocated			

Notes:

[1] Worldwide disgorgement is allocated to the US and the plaintiff states using weights from Solomon Schedule 60 (Summary of Pre-Tax Sales Revenue Distributed to Google by Geographic Area in the US, 2011 - 2021) and Schedule 61 (Pro-Rata of Pre-Tax Sales Revenue Distributed to Google by Geographic Area in the US).

[2] Calculation 1 uses 85.9% for Google Play's actual market share and 73% for but-for market share (15% reduction from 85.9%, based on that ONE Store gained up to 15% after entry in South Korea).

[3] Calculation 2 assumes the actual and but-for Google Play market shares to be the same, 85.9%.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 24

Disgorgement From Changes in the Consumer Subsidy (in Millions USD)

Description	Calculation	Calculation 1 (ONE Store-Based But-for Market Share)	Calculation 2 (But-for Market Share Same as Actual)	Source
Actual Google Play Store Consumer Spend	[A]	[redacted]	[redacted]	Solomon Report, Schedule 4
Actual Service Fee Rate	*[1]*	*29%*	*29%*	Google Play Transactions Data
But-for Service Fee Rate	*[2]*	*29%*	*29%*	Same as Actual
Actual Play Points %	*[3]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Play Points %	*[4]*	[redacted]	[redacted]	Estimated, See Section XI. B
Actual Google Discount %	*[5]*	[redacted]	[redacted]	Google Play Transactions Data
But-for Google Discount %	*[6]*	[redacted]	[redacted]	Estimated, See Section XI. B
Actual Developer Discount	*[7]*	[redacted]	[redacted]	Google Play Transactions Data
Percentage Reduction in Per-Unit Consumer Spend	[B]	[redacted]	[redacted]	Calculated based on [3] - [7]
Reduction in App & Games Revenue	[A]*[B]	[redacted]	[redacted]	Calculated
Demand Elasticity	*[8]*	*1.46*	*1.46*	Singer Merits Report, Table 8
Increase in Market Sales Quantity	[C]	0.8%	0.8%	Calculated based on [3] - [8]
Actual Google Play Apps & Games Revenue	[D]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Market App & Game Revenue	[E] = ([D]-[A]*[B])*(1+[C])	[redacted]	[redacted]	Calculated
Actual Market Share	[F]	85.9%	85.9%	Singer Merits Report, ¶122
But-For Market Share	[G]	73.0%	85.9%	Empirical Evidence/Assumption
But-For Google Play App & Game Revenue	[H] = [E]/[F]*[G]	[redacted]	[redacted]	Calculated
Actual Google Play Other Revenue	[I]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-for Google Play Total Revenue	[J] = [H]+[I]	[redacted]	[redacted]	Calculated
Actual Google Play Operating Profit Margin for App & Games	[K]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-For Google Play App & Games Costs	[L] = [H]*(1-[K])	[redacted]	[redacted]	Calculated
Actual Google Play Other Costs	[M]	[redacted]	[redacted]	Solomon Report, Schedule 5
But-for Total Google Play Costs	[N] = [L]+[M]	[redacted]	[redacted]	Calculated
But-For Incremental Profits	[O] = [J]-[N]	[redacted]	[redacted]	Calculated
Actual Incremental Profits	[P]	[redacted]	[redacted]	Solomon Report, Schedule 2
Disgorgement (Worldwide)	[P] - [O]	[redacted]	[redacted]	**Calculated**
Geographic Area				
US	Allocated	[redacted]	[redacted]	
39 States	Allocated	[redacted]	[redacted]	
1 Alaska	Allocated	[redacted]	[redacted]	
2 Arizona	Allocated	[redacted]	[redacted]	
3 Arkansas	Allocated	[redacted]	[redacted]	
4 California	Allocated	[redacted]	[redacted]	
5 Colorado	Allocated	[redacted]	[redacted]	
6 Connecticut	Allocated	[redacted]	[redacted]	
7 Delaware	Allocated	[redacted]	[redacted]	
8 District of Columbia	Allocated	[redacted]	[redacted]	
9 Florida	Allocated	[redacted]	[redacted]	
10 Idaho	Allocated	[redacted]	[redacted]	
11 Indiana	Allocated	[redacted]	[redacted]	
12 Iowa	Allocated	[redacted]	[redacted]	
13 Kentucky	Allocated	[redacted]	[redacted]	
14 Louisiana	Allocated	[redacted]	[redacted]	
15 Maryland	Allocated	[redacted]	[redacted]	
16 Massachusetts	Allocated	[redacted]	[redacted]	
17 Minnesota	Allocated	[redacted]	[redacted]	
18 Mississippi	Allocated	[redacted]	[redacted]	
19 Missouri	Allocated	[redacted]	[redacted]	
20 Montana	Allocated	[redacted]	[redacted]	
21 Nebraska	Allocated	[redacted]	[redacted]	
22 Nevada	Allocated	[redacted]	[redacted]	
23 New Hampshire	Allocated	[redacted]	[redacted]	
24 New Jersey	Allocated	[redacted]	[redacted]	
25 New Mexico	Allocated	[redacted]	[redacted]	
26 New York	Allocated	[redacted]	[redacted]	
27 North Carolina	Allocated	[redacted]	[redacted]	
28 North Dakota	Allocated	[redacted]	[redacted]	
29 Oklahoma	Allocated	[redacted]	[redacted]	
30 Oregon	Allocated	[redacted]	[redacted]	
31 Rhode Island	Allocated	[redacted]	[redacted]	
32 South Dakota	Allocated	[redacted]	[redacted]	
33 Tennessee	Allocated	[redacted]	[redacted]	
34 Texas	Allocated	[redacted]	[redacted]	
35 Utah	Allocated	[redacted]	[redacted]	
36 Vermont	Allocated	[redacted]	[redacted]	
37 Virginia	Allocated	[redacted]	[redacted]	
38 Washington	Allocated	[redacted]	[redacted]	
39 West Virginia	Allocated	[redacted]	[redacted]	

Notes:

[1] Worldwide disgorgement is allocated to the US and the plaintiff states using weights from Solomon Schedule 60 (Summary of Pre-Tax Sales Revenue Distributed to Google by Geographic Area in the US, 2011 - 2021) and Schedule 61 (Pro-Rata of Pre-Tax Sales Revenue Distributed to Google by Geographic Area in the US).

[2] Calculation 1 uses 85.9% for Google Play's actual market share and 73% for but-for market share (15% reduction from 85.9%, based on that ONE Store gained up to 15% after entry in South Korea).

[3] Calculation 2 assumes the actual and but-for Google Play market shares to be the same, 85.9%.

Source:

[1] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 25

Summary of the Match Plaintiffs' Damages for OkCupid and Tinder

Using Dr. Schwartz's Damages Model

		Main Damages Period		Alternative Damages Period		1/1/2022 — 5/20/2022	
		Base Case	**High Rate**	**Base Case**	**High Rate**	**Base Case**	**High Rate**
Dr. Schwartz's Calculations	OkCupid	[redacted]					
	Tinder						
	Total						
Dr. Schwartz's Calculations After Correcting for Mishandling of Google Play Transactions Data	OkCupid						
	Tinder						
	Total						
Sensitivity Analysis #1	OkCupid						
	Tinder						
	Total						
Sensitivity Analysis #2	OkCupid						
	Tinder						
	Total						
Sensitivity Analysis #3	OkCupid						
	Tinder						
	Total						
Sensitivity Analysis #4	OkCupid						
	Tinder						
	Total						
Sensitivity Analysis #5	OkCupid						
	Tinder						
	Total						
Sensitivity Analysis #6	OkCupid						
	Tinder						
	Total						

Notes:

[1] See Exhibits 26a-26d for Dr. Schwartz's calculations after correcting for mishandling of Google Play transactions data.
[2] See Exhibits 27a-27d for Sensitivity Analysis #1.
[3] See Exhibits 28a-28d for Sensitivity Analysis #2.
[4] See Exhibits 29a-29d for Sensitivity Analysis #3.
[5] See Exhibits 30a-30d for Sensitivity Analysis #4.
[6] See Exhibits 31a-31d for Sensitivity Analysis #5.
[7] See Exhibits 32a-32d for Sensitivity Analysis #6.

Exhibit 25

Sources:

[1] Exhibits 26a, 26b.
[2] Exhibits 27a, 27b.
[3] Exhibits 28a, 28b.
[4] Exhibits 29a, 29b.
[5] Exhibits 30a, 30b.
[6] Exhibits 31a, 31b.
[7] Exhibits 32a, 32b.
[8] Attachment E-6, Expert Report of Dr. Schwartz, October 3, 2022.
[9] Attachment F-6, Expert Report of Dr. Schwartz, October 3, 2022.
[10] Attachment G-4, Expert Report of Dr. Schwartz, October 3, 2022.

[redacted]

Sources:

[1] Exhibit 26c.

[2] Exhibits 34a, 34d, 34e, 34g.

[redacted]

Sources:

[1] Exhibit 26d.

[2] Exhibits 34h, 34i.

[redacted]

Sources:

[1] GOOG-PLAY-000337564.

[2] GOOG-PLAY-001127244.

[3] Exhibit 34e.

[redacted]

Sources:

[1] Exhibit 26a.

[2] Exhibits 34e, 34h.

[redacted]

Sources:

[1] Exhibit 27c.

[2] Exhibits 34a, 34d, 34e, 34g.

[redacted]

Sources:

[1] Exhibit 27d.

[2] Exhibits 34h, 34i.

[redacted]

Sources:

[1] GOOG-PLAY-004625919, tab ("data").

[2] GOOG-PLAY-001127244.

[3] Exhibit 34e.

[redacted]

Sources:

[1] Exhibit 27a.

[2] Exhibits 34e, 34h.

[redacted]

Sources:

[1] Exhibit 28c.

[2] Exhibits 34a, 34d, 34e, 34g.

[redacted]

Sources:

[1] Exhibit 28d.

[2] Exhibits 34h, 34i.

[redacted]

Sources:

[1] GOOG-PLAY-001127244.

[2] Exhibit 34e.

[redacted]

Sources:

[1] Exhibit 28a.

[2] Exhibits 34e, 34h.

[redacted]

Sources:

[1] Exhibit 29c.

[2] Exhibits 34a, 34d, 34e, 34g.

[redacted]

Sources:

[1] Exhibit 29d.

[2] Exhibits 34h, 34i.

[redacted]

Sources:

[1] GOOG-PLAY-004625919, tab ("data").

[2] GOOG-PLAY-001127244.

[3] Exhibit 34e.

[redacted]

Sources:

[1] Exhibit 29a.

[2] Exhibits 34e, 34h.

[redacted]

Sources:

[1] Exhibit 30c.

[2] Exhibits 34a, 34d, 34e, 34g.

[redacted]

Sources:

[1] Exhibit 30d.

[2] Exhibits 34h, 34i.

[redacted]

Sources:

[1] GOOG-PLAY-001127244.

[2] Exhibit 34e, 34g.

[redacted]

Sources:

[1] Exhibit 30a.

[2] Exhibits 34e, 34h.

[redacted]

Sources:

[1] Exhibit 31c.

[2] Exhibits 34a, 34d, 34e, 34g.

[redacted]

Sources:

[1] Exhibit 31d.

[2] Exhibits 34h, 34i.

[redacted]

Sources:

[1] GOOG-PLAY-004625919, tab ("data").

[2] Exhibits 34e.

[redacted]

Sources:

[1] Exhibit 31a.

[2] Exhibits 34e, 34h.

[redacted]

Sources:

[1] Exhibit 32c.

[2] Exhibits 34a, 34d, 34e, 34g.

[redacted]

Sources:

[1] Exhibit 32d.

[2] Exhibits 34h, 34i.

[redacted]

Sources:

[1] GOOG-PLAY-004625919, tab ("data").

[2] Exhibits 34e.

[redacted]

Sources:

[1] Exhibit 32a.

[2] Exhibits 34e, 34h.

[redacted]

[redacted]

Sources:

[1] MATCHGOOGLE00105742.
[2] MATCHGOOGLE00105770.
[3] MATCHGOOGLE00105797
[4] MATCHGOOGLE00105815.
[5] MATCHGOOGLE00115561.

[redacted]

Sources:

[1] MATCHGOOGLE00105742.
[2] MATCHGOOGLE00105770.
[3] MATCHGOOGLE00105797
[4] MATCHGOOGLE00105815.
[5] MATCHGOOGLE00115561.

[redacted]

Source:

[1] Exhibit 33e.

[redacted]

Sources:

[1] MATCHGOOGLE00105742.
[2] MATCHGOOGLE00105770.
[3] MATCHGOOGLE00105797.
[4] MATCHGOOGLE00105815.
[5] MATCHGOOGLE00106377.
[6] MATCHGOOGLE00106378.
[7] MATCHGOOGLE00106379.
[8] MATCHGOOGLE00106380.
[9] MATCHGOOGLE00115561.
[10] MATCHGOOGLE00115566.
[11] MATCHGOOGLE00119761.

[redacted]

Sources:

[1] MATCHGOOGLE00105770.

[2] MATCHGOOGLE00115561.

[3] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 34b

Transaction Fees of Alternative Payment Processing Providers

2017 – 2021

Payment Processing Providers	Transaction Fee 2017 % of Revenue	2017 Flat fee	2018 % of Revenue	2018 Flat fee	2019 % of Revenue	2019 Flat fee	2020 % of Revenue	2020 Flat fee	2021 % of Revenue	2021 Flat fee
Adyen	3.95%	$0.12	3.95%	$0.12	3.95%	$0.12	3.95%	$0.12	3.95%	$0.12
Amazon Pay	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30
Authorize.net	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30
Braintree	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30
Clover	3.50%	$0.10	3.50%	$0.10	3.50%	$0.10	3.50%	$0.10	3.50%	$0.10
PayPal	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30	2.70%	$0.30	2.70%	$0.30
Square	-	-	-	-	-	-	2.90%	$0.30	2.90%	$0.30
Stax	-	-	-	-	-	-	-	-	-	-
Stripe	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30	2.90%	$0.30
Vanco	2.27%	$0.45	2.27%	$0.45	2.27%	$0.45	2.27%	$0.45	2.27%	$0.45
Chase	2.90%	$0.25	2.90%	$0.25	2.90%	$0.25	2.90%	$0.25	2.90%	$0.25

Source:

[1] Attachment C-2, Expert Report of Dr. Schwartz, October 3, 2022.

[redacted]

Sources:

[1] Exhibits 34a-34b.

[redacted]

Sources:

[1] Attachment C-4, Expert Report of Dr. Schwartz, October 3, 2022.

[2] Exhibits 34a, 34c.

[redacted]

Sources:

[1] MATCHGOOGLE00105770.

[2] MATCHGOOGLE00115561.

[redacted]

Sources:

[1] MATCHGOOGLE00105770.

[2] MATCHGOOGLE00115561.

[3] Exhibit 34e.

[redacted]

Sources:

[1] MATCHGOOGLE00105770.
[2] MATCHGOOGLE00115561.
[3] GOOG-PLAY-004625919, tab ("data").
[4] GOOG-PLAY-011274244.

[redacted]

Sources:

[1] MATCHGOOGLE00105770.

[2] MATCHGOOGLE00115561.

[3] Google Play transactions data: GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

[redacted]

Sources:

[1] Attachment C-4, Expert Report of Dr. Schwartz, October 3, 2022.

[2] Exhibits 34c, 34h.

Exhibit C1

Pass-Through Rate Estimation

Time Period: July 2020 - June 2021

Placebo Test

	IAPs	Paid Downloads	Subscriptions
Pass-Through Rate	[redacted]		
P-Value	0.68	0.62	0.88
Number of Treated SKUs	16,047	3,113	2,874
Number of Control SKUs	11,507	1,404	3,295
Number of SKU-Month Obs.	330,648	54,204	74,028

Notes:

[1] The sample includes the treated SKUs subject to a 29.5%-30.5% service fee rate in the pre period (from July 2020 to June 2021) and 14.5%-15.5% in the post period (from July 2021 to May 2022), and the control SKUs subject to a 29.5%-30.5% service fee rate throughout July 2020 and May 2022.

[2] The sample is "balanced" by restricting to include only SKUs with non-zero sales in every month betweeen July 2020 and May 2022.

[3] A placebo sample is created by truncating the sample in June 2021, before the real intervention took place, and starting artificial treatment in March 2021. The analysis period becomes July 2020 to June 2021.

[4] A low p-value (<= 0.05) indicates that the regression estimate is statistically significant, i.e., one can reject the null hypothesis that the regression estimate is zero; a high p-value (> 0.05) indicates that the regression estimate is not statistically significant, i.e., one cannot reject the null hypothesis that the regression estimate is zero.

Source:

[1] Google Play transaction data; GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit C2

Pass-Through Rate Estimation

Time Period: July 2020 - May 2022

Limiting SKUs to Those Accounting for 99% of Spend

	IAPs	Paid Downloads
Pass-Through Rate	[redacted]	
P-Value	0.29	0.99
Number of Treated SKUs	7,154	3,036
Number of Control SKUs	7,962	1,340
Number of SKU-Month Obs.	347,668	100,648

Notes:

[1] The smallest SKUs jointly contributing to less than 1% revenue in each sample are dropped.

[2] The sample includes the treated SKUs subject to a 29.5%-30.5% service fee rate in the pre period (from July 2020 to June 2021) and 14.5%-15.5% in the post period (from July 2021 to May 2022), and the control SKUs subject to a 29.5%-30.5% service fee rate throughout July 2020 and May 2022.

[3] The sample is "balanced" by restricting to include only SKUs with non-zero sales in every month betweeen July 2020 and May 2022.

[4] A low p-value (<= 0.05) indicates that the regression estimate is statistically significant, i.e., one can reject the null hypothesis that the regression estimate is zero; a high p-value (> 0.05) indicates that the regression estimate is not statistically significant, i.e., one cannot reject the null hypothesis that the regression estimate is zero.

Source:

[1] Google Play transaction data; GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit C3

Pass-Through Rate Estimation

Time Period: July 2020 - December 2021

Shortened Treatment Period

	IAPs	Paid Downloads
Pass-Through Rate	[redacted]	
P-Value	0.56	0.94
Number of Treated SKUs	16,047	3,113
Number of Control SKUs	11,507	1,404
Number of SKU-Month Obs.	495,972	81,306

Notes:

[1] The sample includes the treated SKUs subject to a 29.5%-30.5% service fee rate in the pre period (from July 2020 to June 2021) and 14.5%-15.5% in the post period (from July 2021 to May 2022), and the control SKUs subject to a 29.5%-30.5% service fee rate throughout July 2020 and May 2022.

[2] The sample is "balanced" by restricting to include only SKUs with non-zero sales in every month betweeen July 2020 and May 2022.

[3] The treatment period is defined as July 2021 and December 2021.

[4] A low p-value (<= 0.05) indicates that the regression estimate is statistically significant, i.e., one can reject the null hypothesis that the regression estimate is zero; a high p-value (> 0.05) indicates that the regression estimate is not statistically significant, i.e., one cannot reject the null hypothesis that the regression estimate is zero.

Source:

[1] Google Play transaction data; GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit C4

Pass-Through Rate Estimation

Time Period: July 2020 - May 2022

Limiting SKUs to Those in App Categories with a Low Treatment Group Revenue Share

	IAPs	Paid Downloads
Pass-Through Rate	[redacted]	
P-Value	0.58	0.99
Number of Treated SKUs	8,663	318
Number of Control SKUs	8,535	116
Number of SKU-Month Obs.	395,554	9,982

Notes:

[1] The sample includes the treated SKUs subject to a 29.5%-30.5% service fee rate in the pre period (from July 2020 to June 2021) and 14.5%-15.5% in the post period (from July 2021 to May 2022), and the control SKUs subject to a 29.5%-30.5% service fee rate throughout July 2020 and May 2022.

[2] The sample is "balanced" by restricting to include only SKUs with non-zero sales in every month betweeen July 2020 and May 2022.

[3] The sample is further filtered based on the share of pre-period final consumer spend from the treatment group for each app category. For IAPs, if the treatment group's revenue share in a given app category is equal to or greater than 10%, then SKUs in that app category are dropped. For paid apps, the threshold is 40%.

[4] A low p-value (<= 0.05) indicates that the regression estimate is statistically significant, i.e., one can reject the null hypothesis that the regression estimate is zero; a high p-value (> 0.05) indicates that the regression estimate is not statistically significant, i.e., one cannot reject the null hypothesis that the regression estimate is zero.

Source:

[1] Google Play transaction data; GOOG-PLAY-007203251; GOOG-PLAY3-000018260.

Exhibit 35a

Average Monthly Product Price and Service Fee Rate for the Top 100 Paid Apps With A Flat Service Fee Rate Reduction of 15 Percentage Points After July 2021

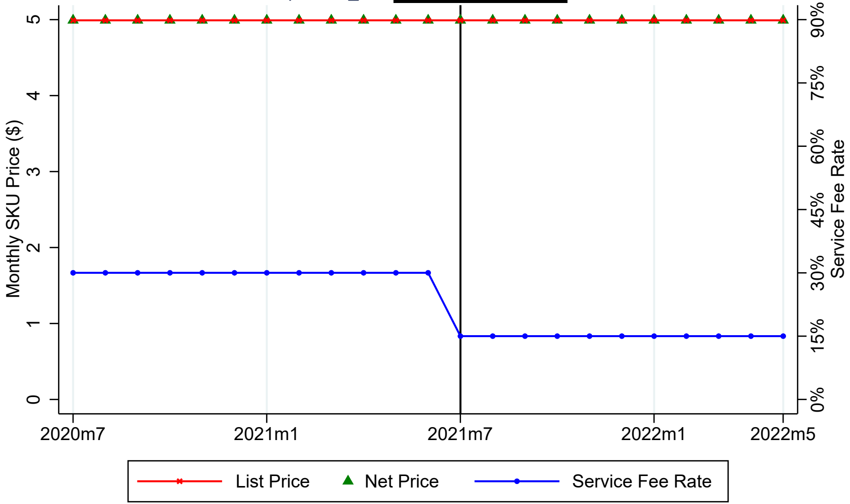
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 1.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 93% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 2.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 82% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 3.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

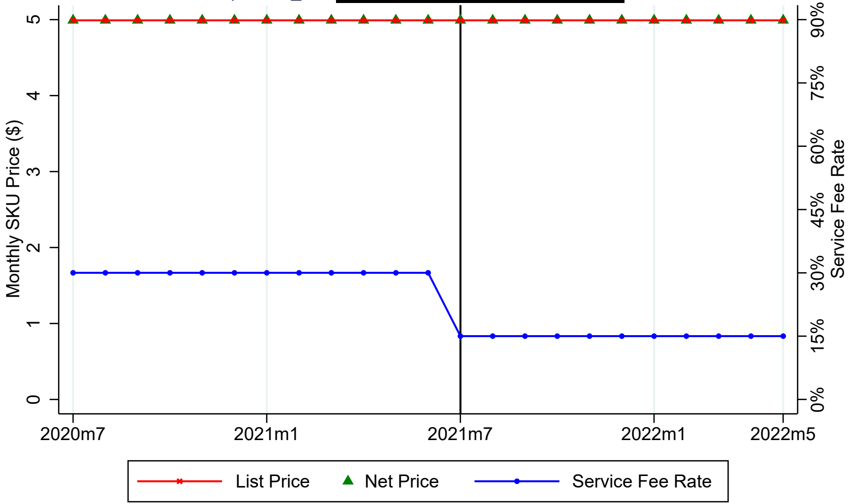


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 4.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

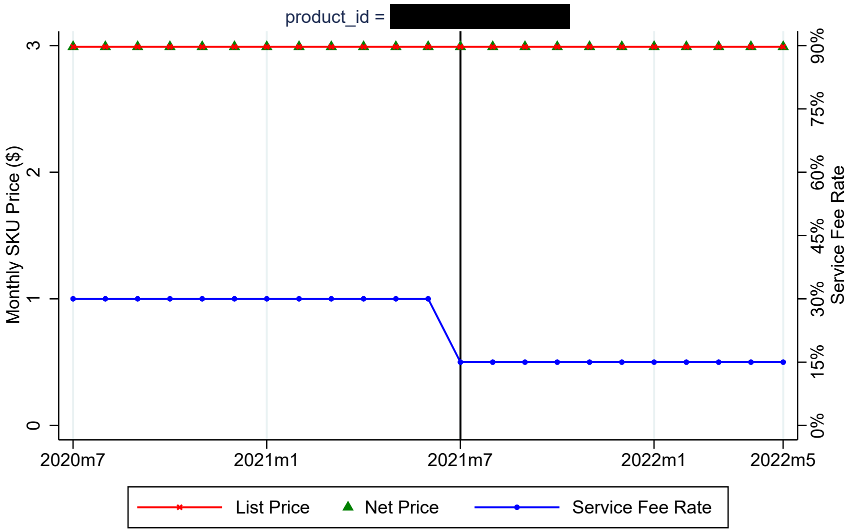
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 6.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 62% (for the corresponding app category); 80% (for the corresponding app developer).

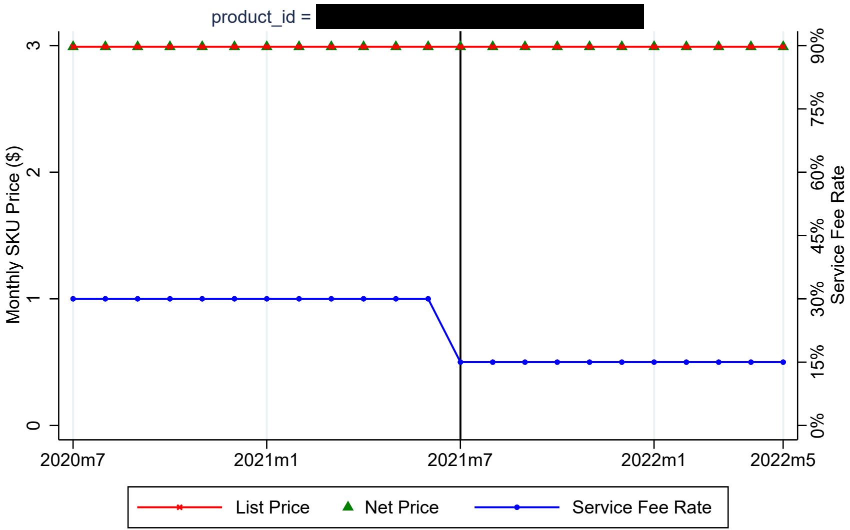
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 11.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 95% (for the corresponding app category); 82% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 13.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 87% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 15.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 53% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 18.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 20.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 21.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 93% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]

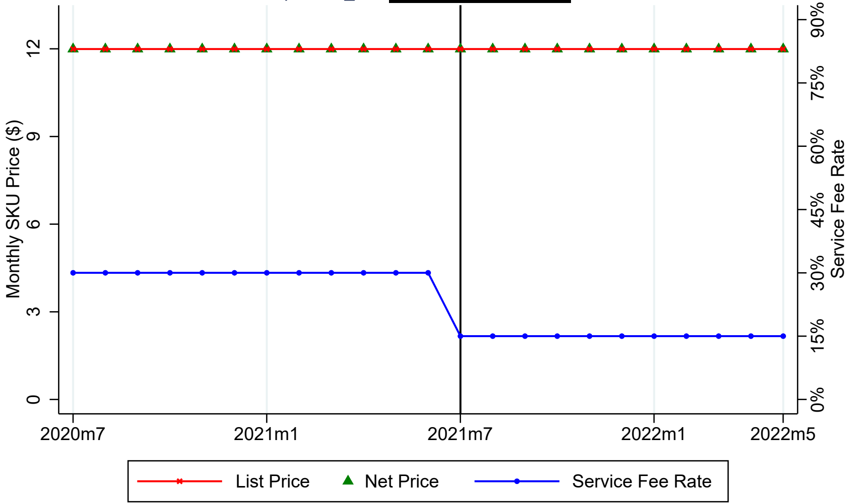
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 25.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 26.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 27.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

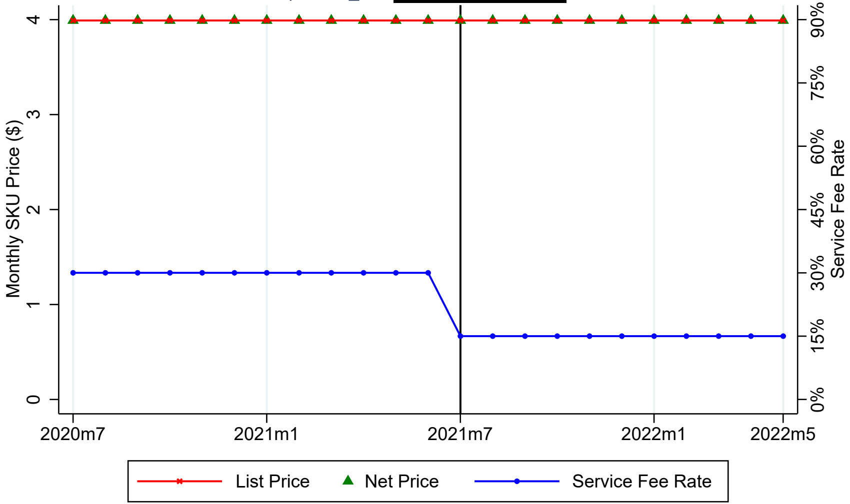
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 29.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 93% (for the corresponding app developer).

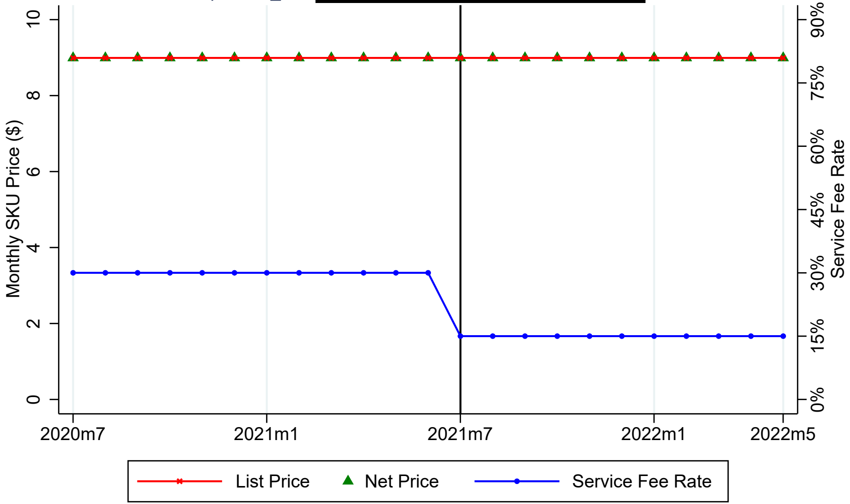
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 32.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]



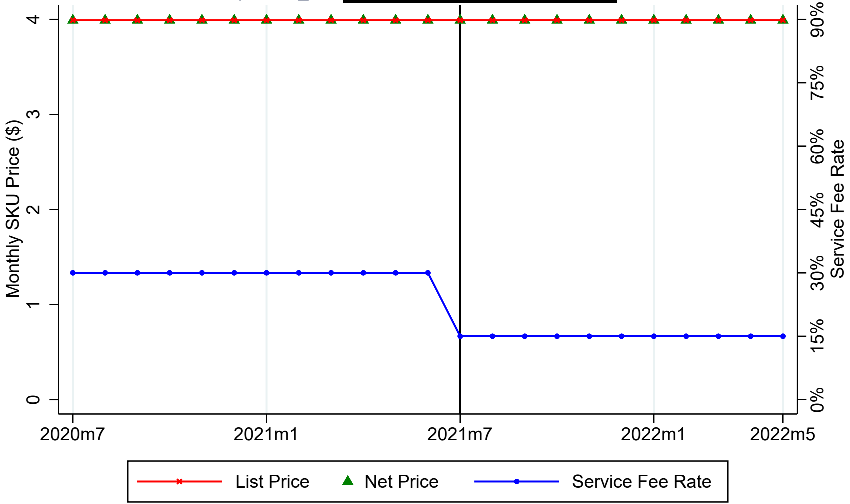
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 35.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

product_id = [redacted]



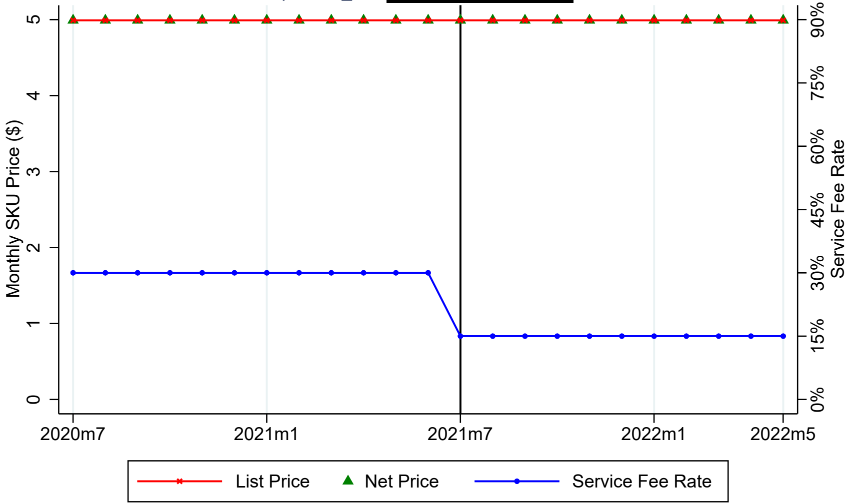
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 38.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 82% (for the corresponding app category);
89% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 43.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 95% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 47.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 99% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 51.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 95% (for the corresponding app developer).

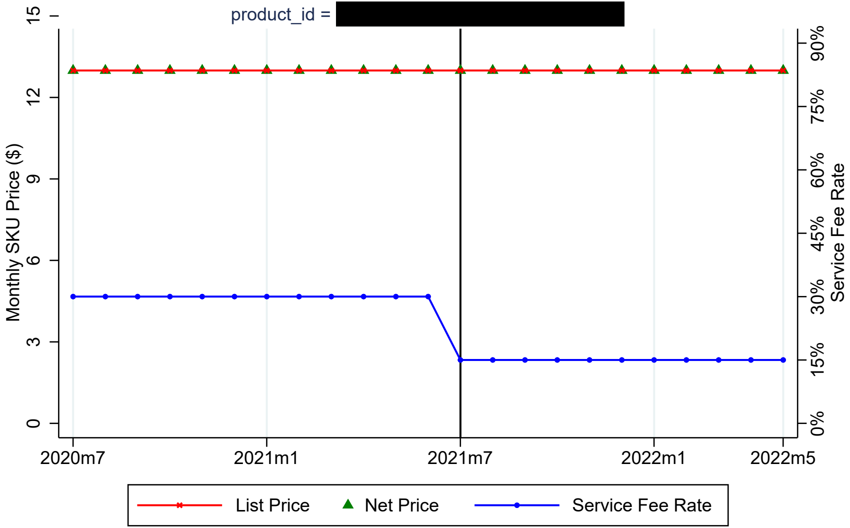
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 54.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 55.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]



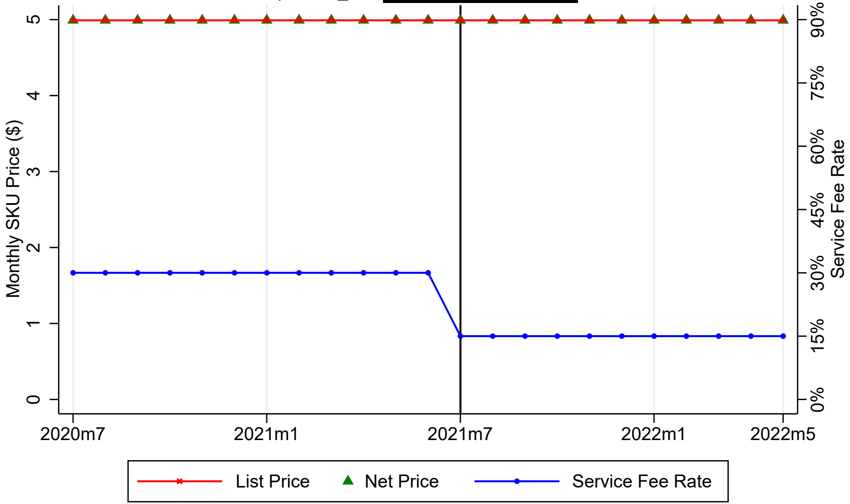
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 58.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 59.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 91% (for the corresponding app developer).

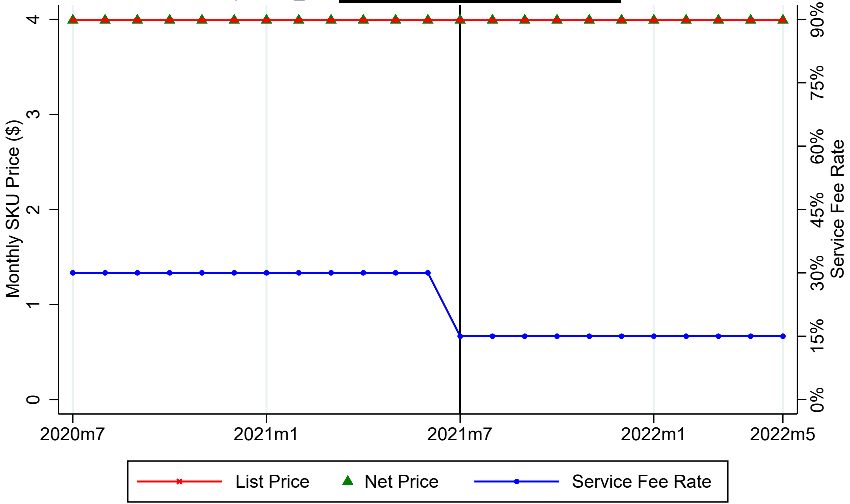
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 60.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category);
98% (for the corresponding app developer).

product_id = [redacted]



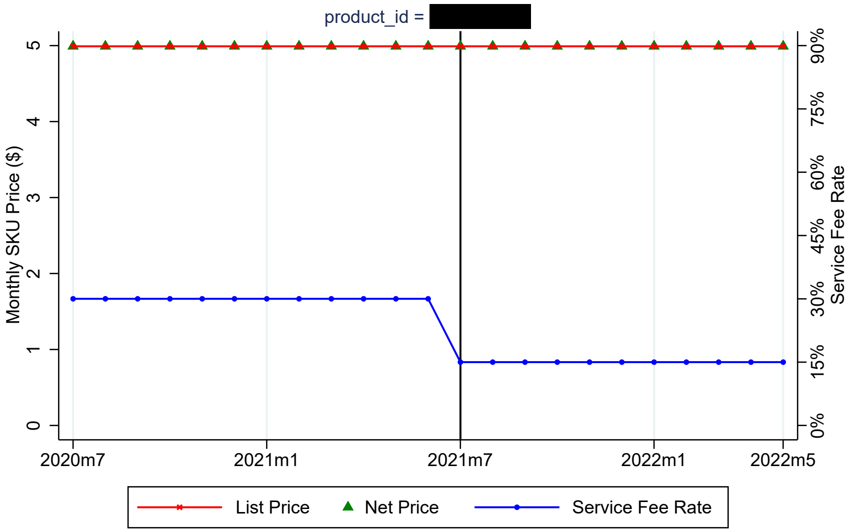
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 61.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 64.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 82% (for the corresponding app category); 66% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 65.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

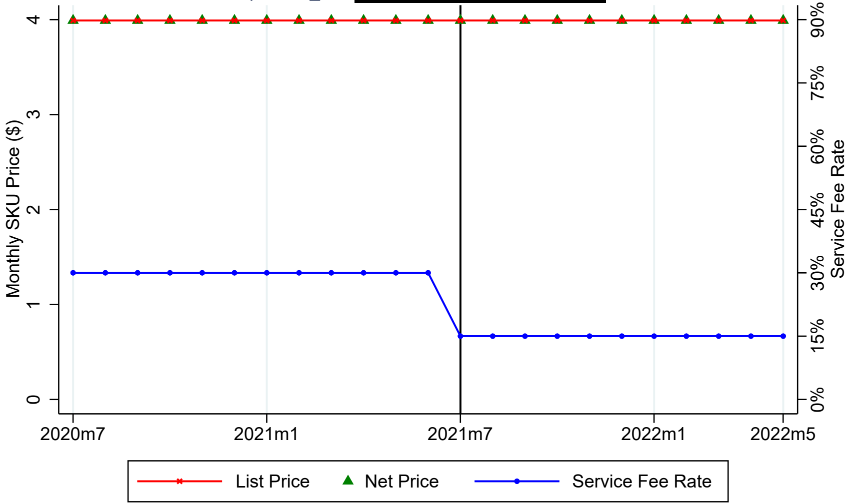


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 73.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 62% (for the corresponding app category); 94% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 74.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 99% (for the corresponding app developer).

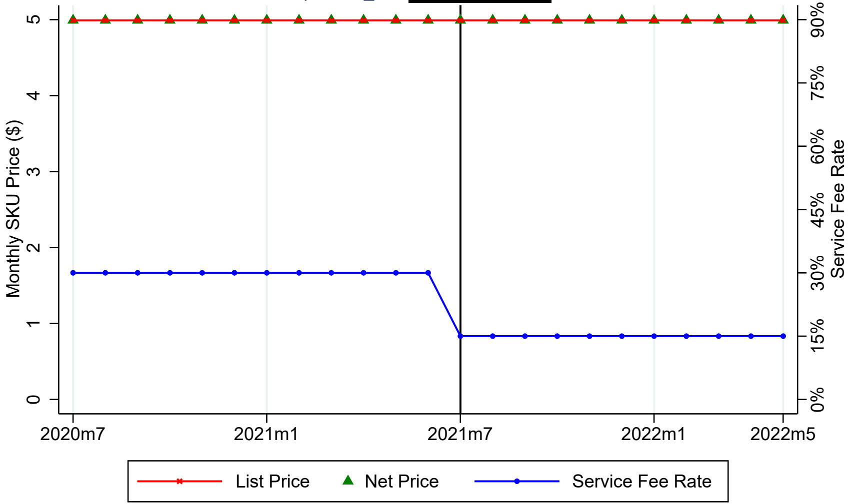
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 76.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



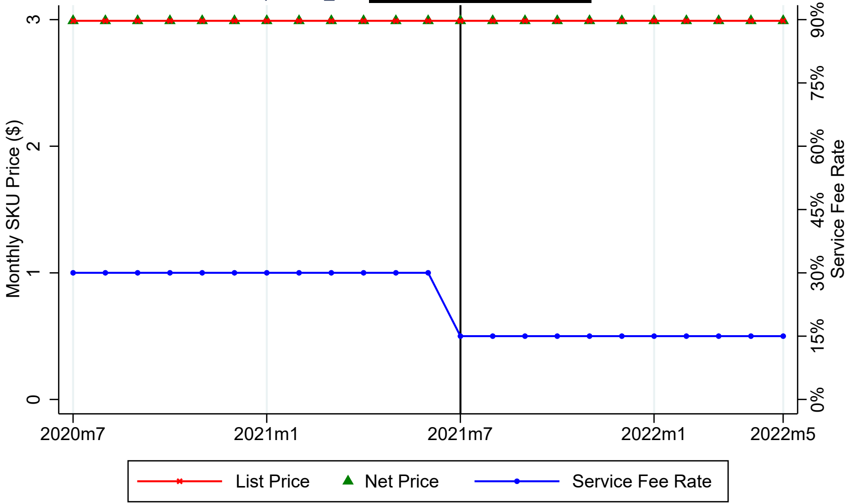
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 77.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 78.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

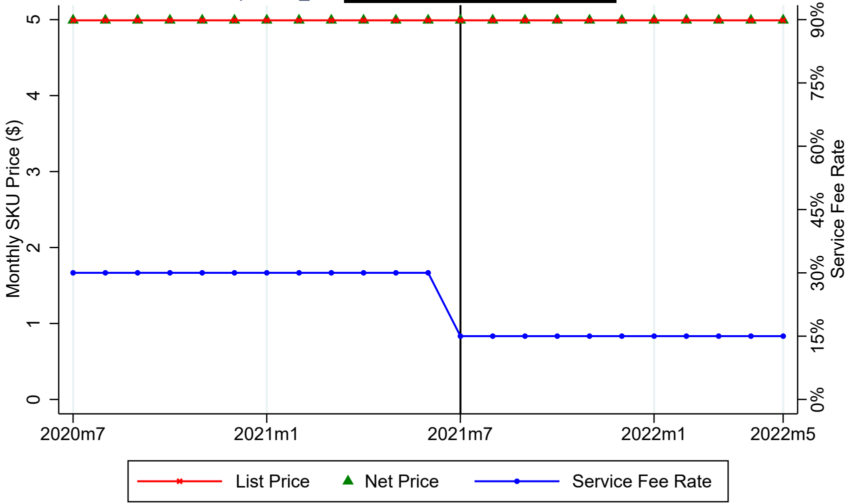


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 81.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category);
99% (for the corresponding app developer).

product_id = [redacted]

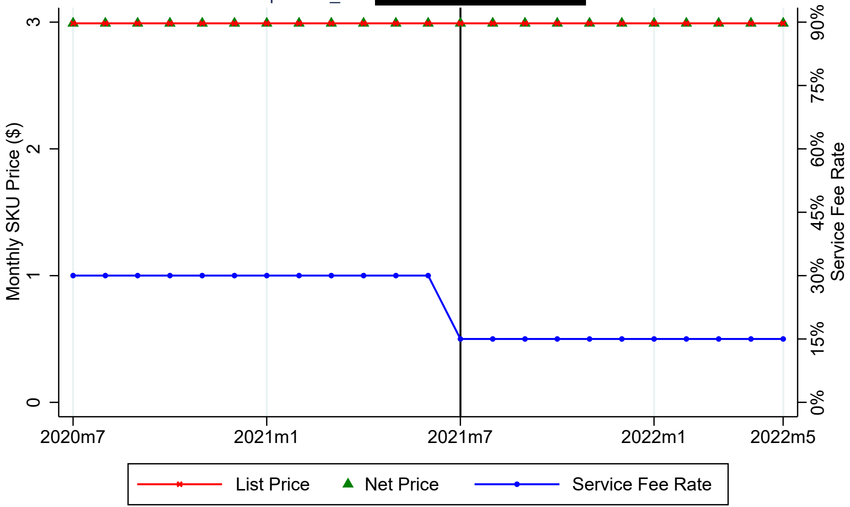
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 82.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 85.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]



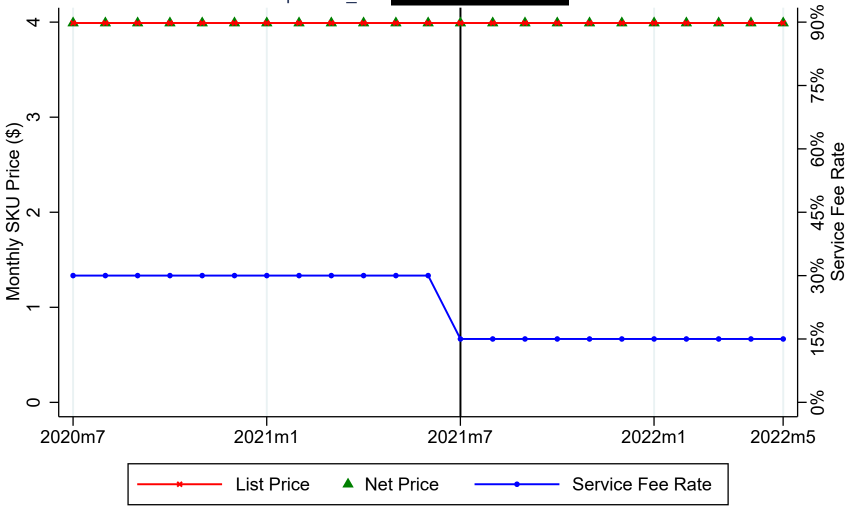
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 86.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 95% (for the corresponding app category); 96% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 87.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 72% (for the corresponding app category); 94% (for the corresponding app developer).

product_id = [redacted]

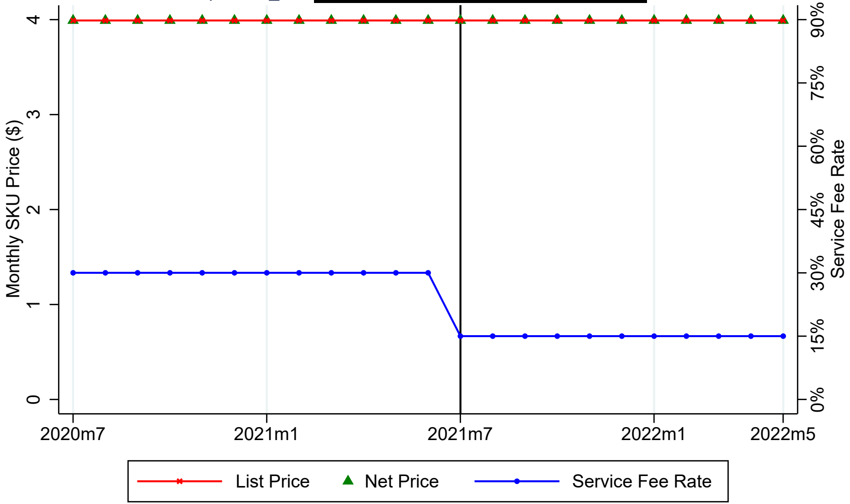
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 89.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 92% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 93.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]

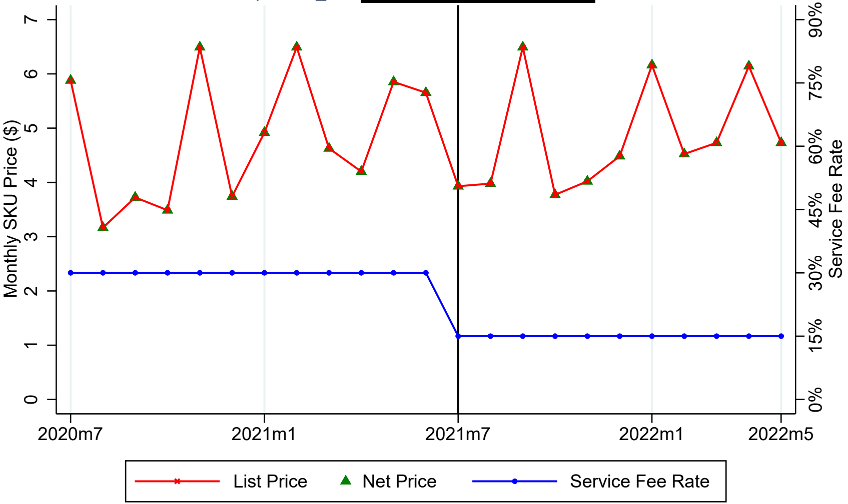


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 94.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 96.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 97.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 99.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 5.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 69% (for the corresponding app category); 55% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 7.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 10.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 95% (for the corresponding app category);
88% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 12.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 14.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 17.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 19.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 96% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 22.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 23.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

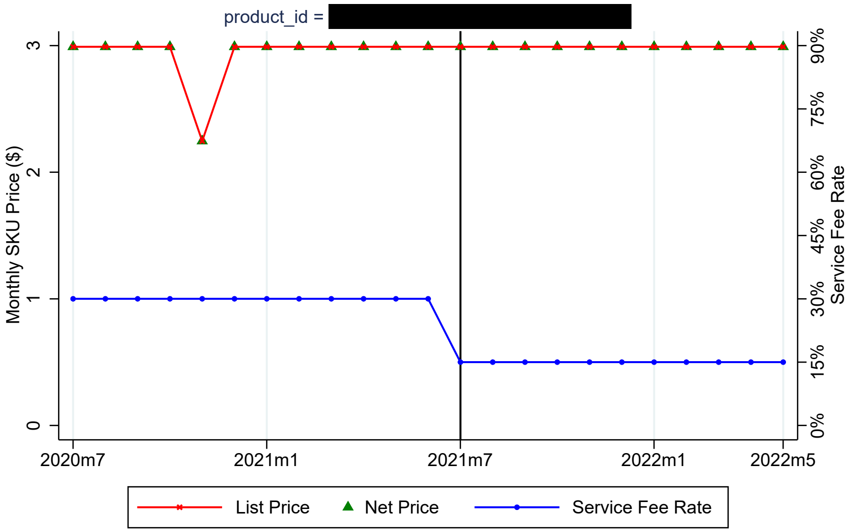
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 24.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]

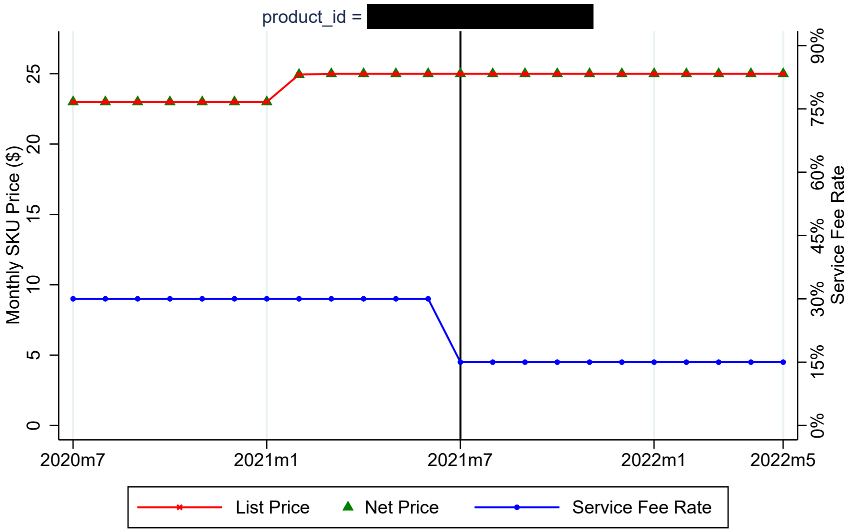
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 28.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 68% (for the corresponding app category); 92% (for the corresponding app developer).

product_id = [redacted]

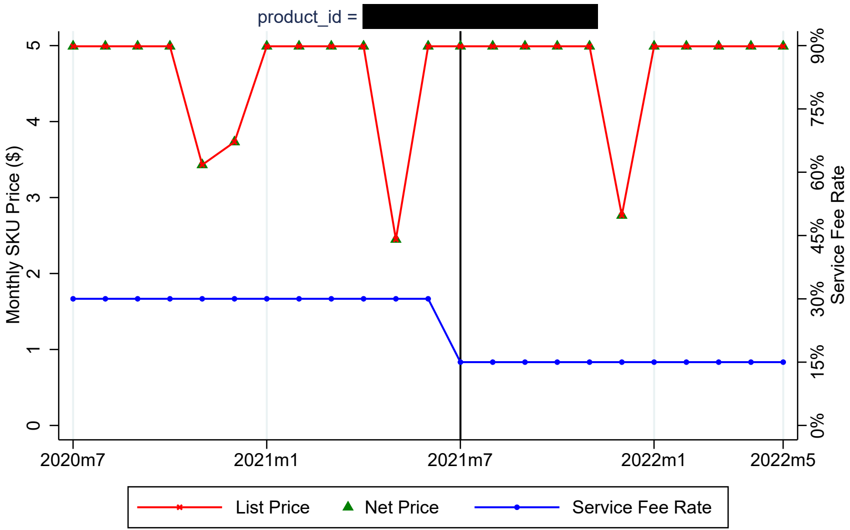
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 30.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 87% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 31.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 93% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 33.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 36.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 39.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 51% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 40.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 41.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 48.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 50.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 98% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 53.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

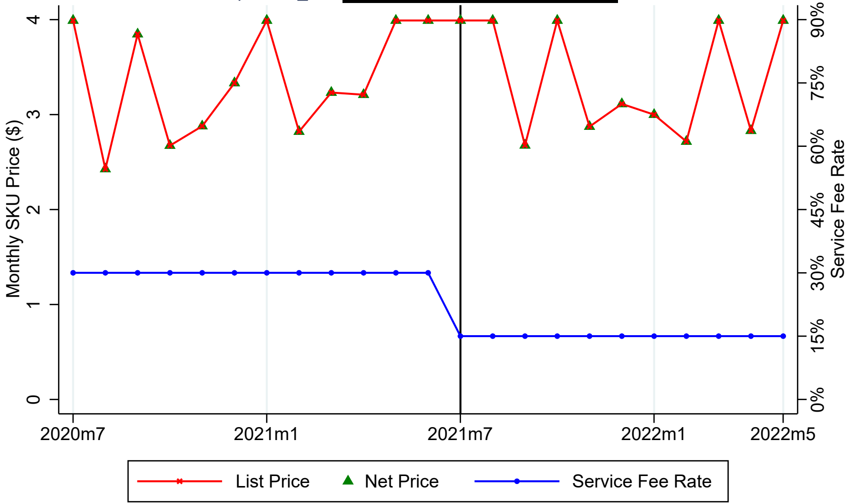
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 56.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 62% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 57.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 93% (for the corresponding app developer).

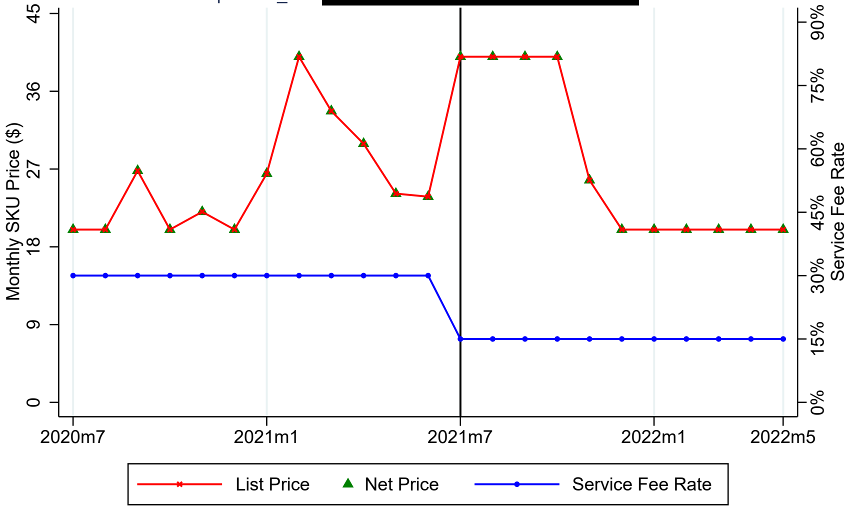
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 63.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]



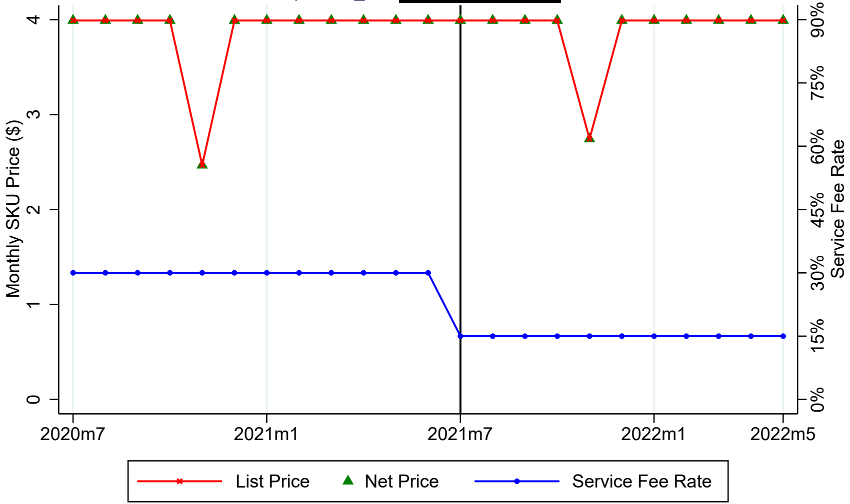
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 66.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 72.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 75.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 90% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 79.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 91% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 84.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 93% (for the corresponding app developer).

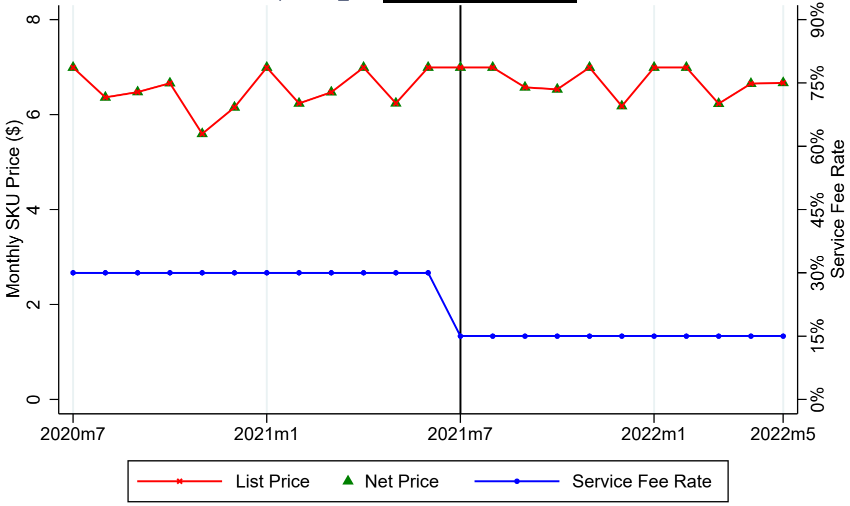
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 88.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

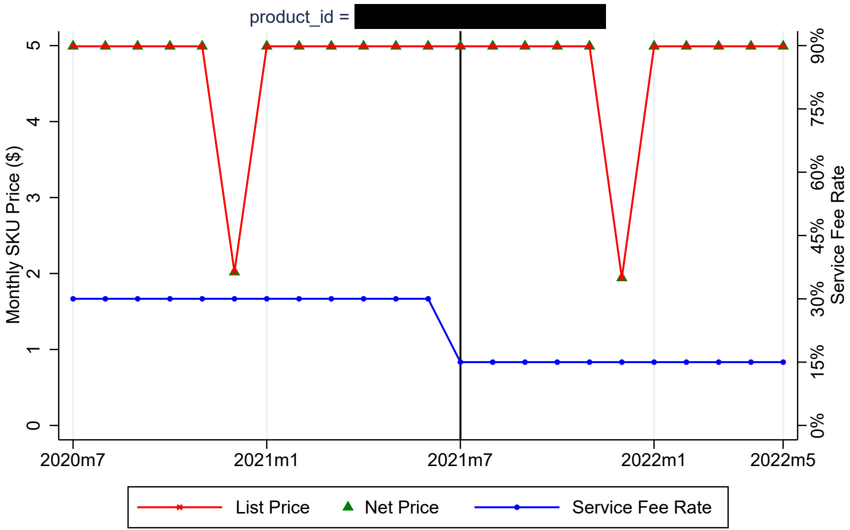
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 92.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 87% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 100.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 97% (for the corresponding app developer).



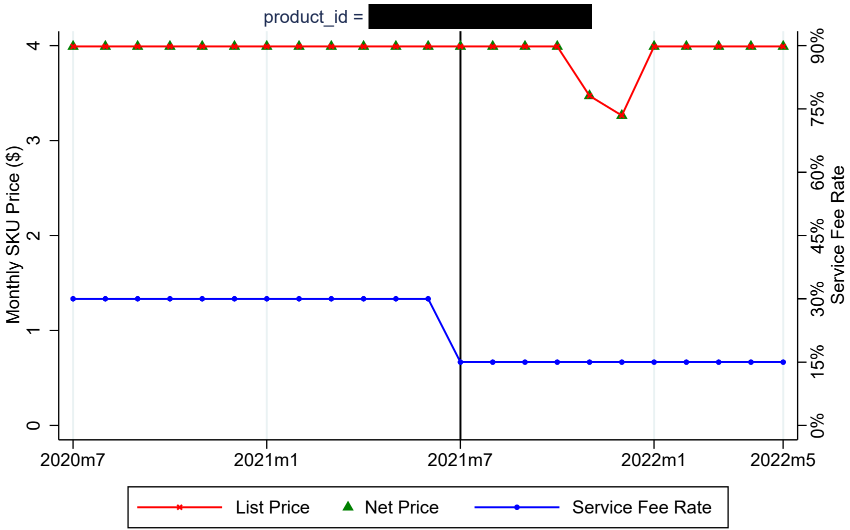
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 8.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 87% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 9.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 16.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 97% (for the corresponding app developer).

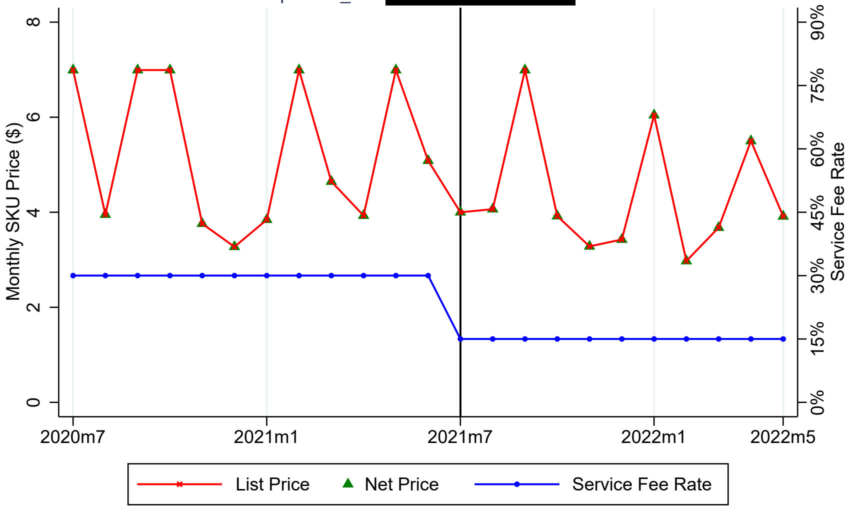


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 34.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 37.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 42.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 92% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 44.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 45.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category);
94% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 46.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 49.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 52.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 62.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 98% (for the corresponding app developer).

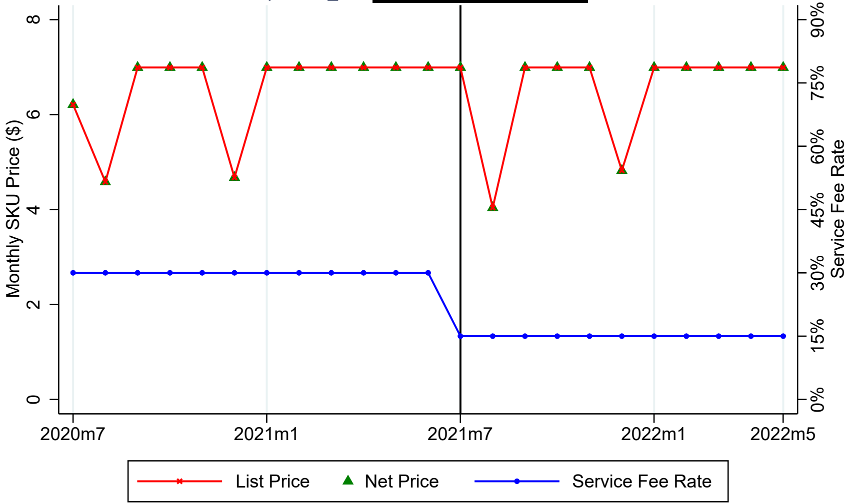
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 67.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category);
98% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 68.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 69.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 70.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 93% (for the corresponding app developer).

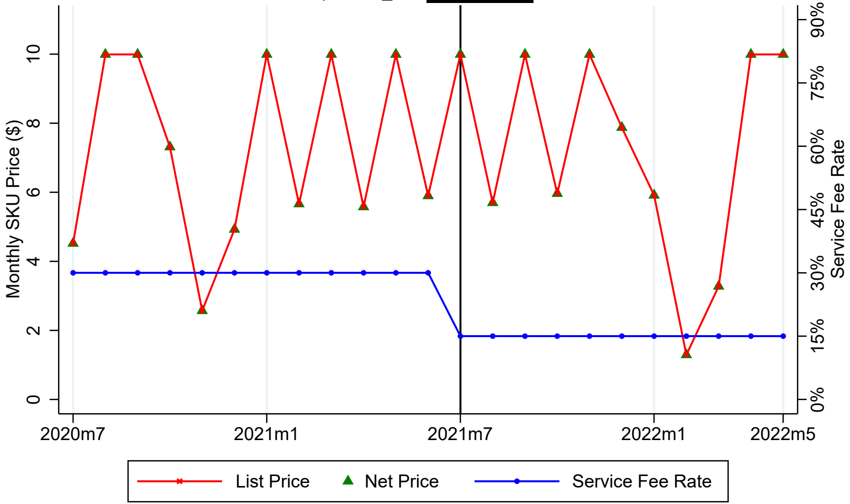
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 71.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 92% (for the corresponding app developer).

product_id = [redacted]

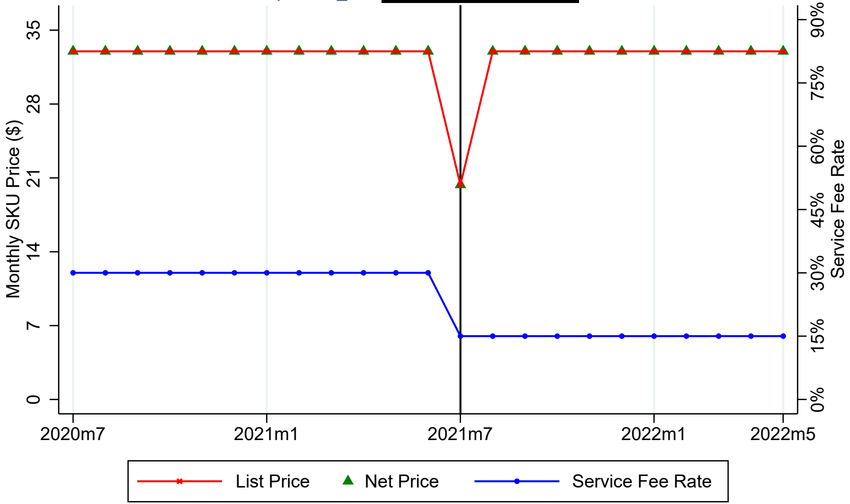
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 80.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 83.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



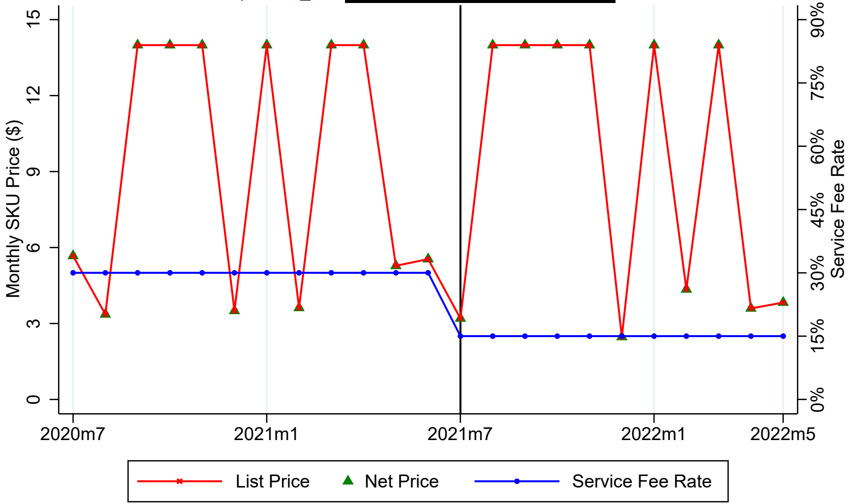
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 90.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 100% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 91.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 95.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 98.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 95% (for the corresponding app developer).

Exhibit 35b

Average Monthly Product Price and Service Fee Rate for the Top 100 Paid Apps With A Service Fee Rate Reduction of At Least 10 Percentage Points in July 2021

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 2.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 3.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 82% (for the corresponding app developer).

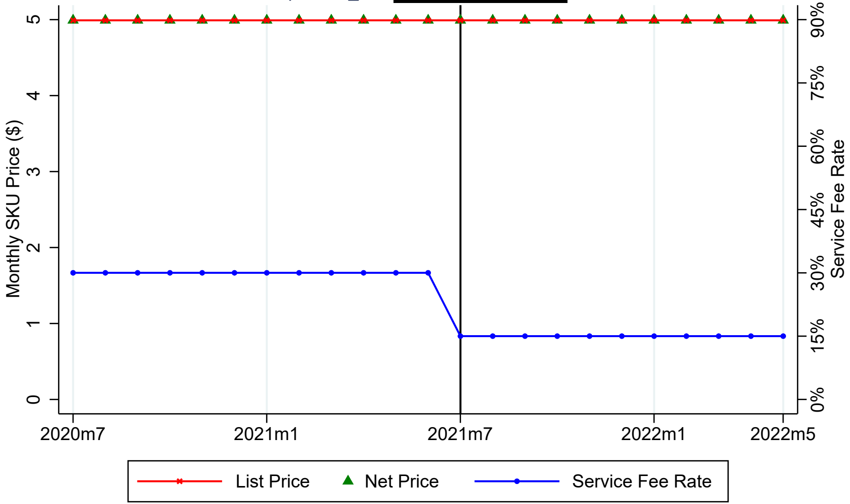
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 4.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 5.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 7.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

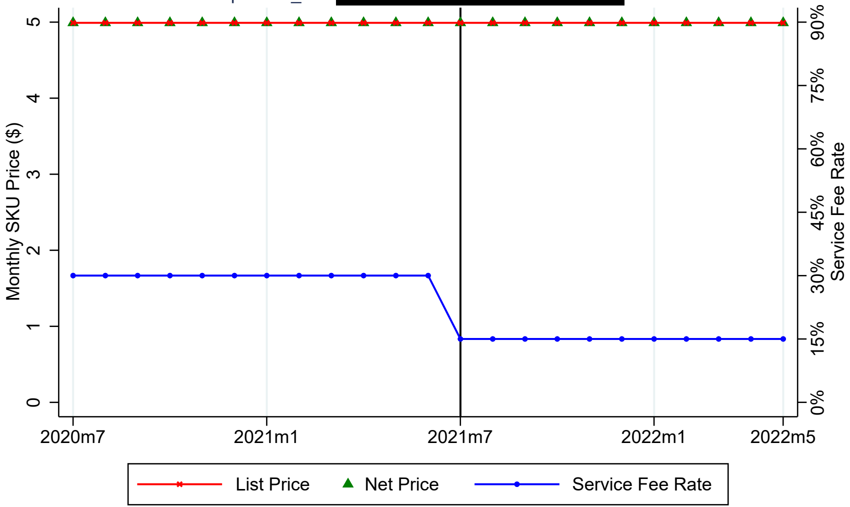
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 9.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 62% (for the corresponding app category); 80% (for the corresponding app developer).

product_id = [redacted]

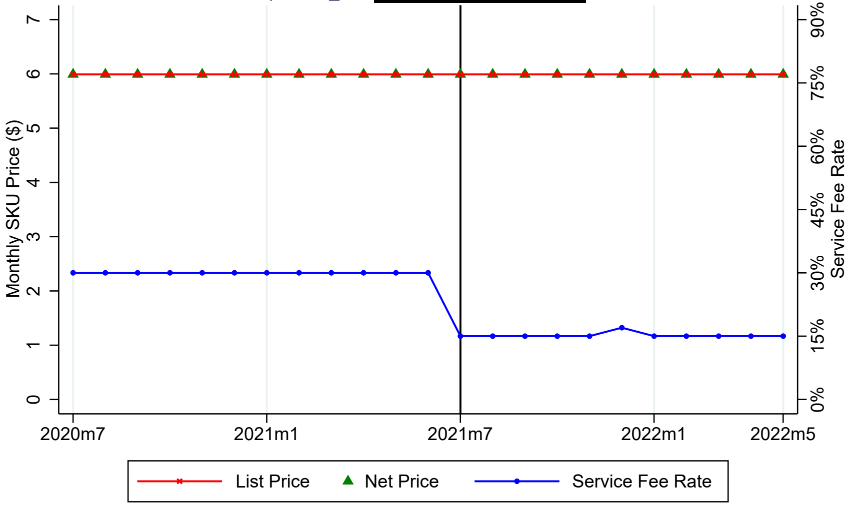
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 15.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

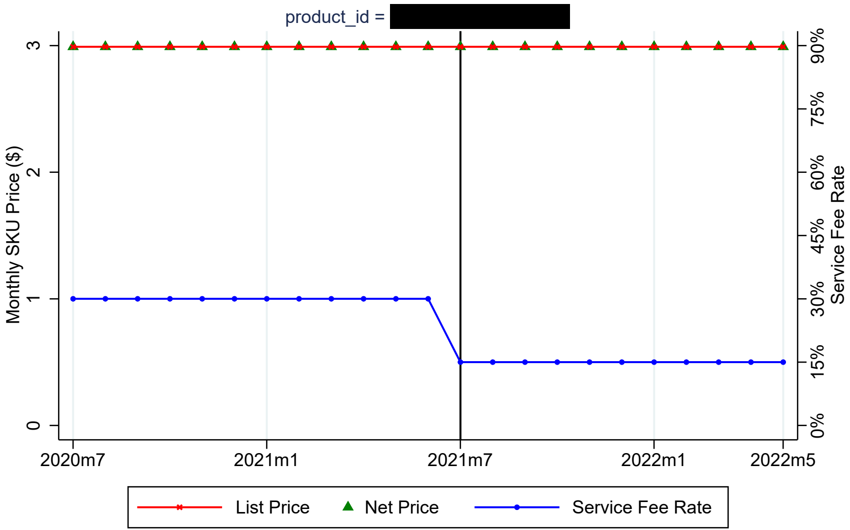


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 17.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 95% (for the corresponding app category);
82% (for the corresponding app developer).

product_id = [redacted]

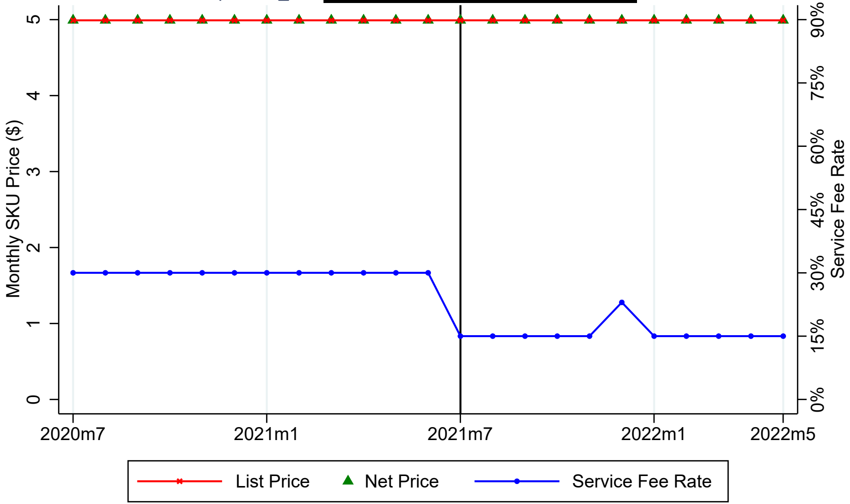


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 18.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 98% (for the corresponding app developer).



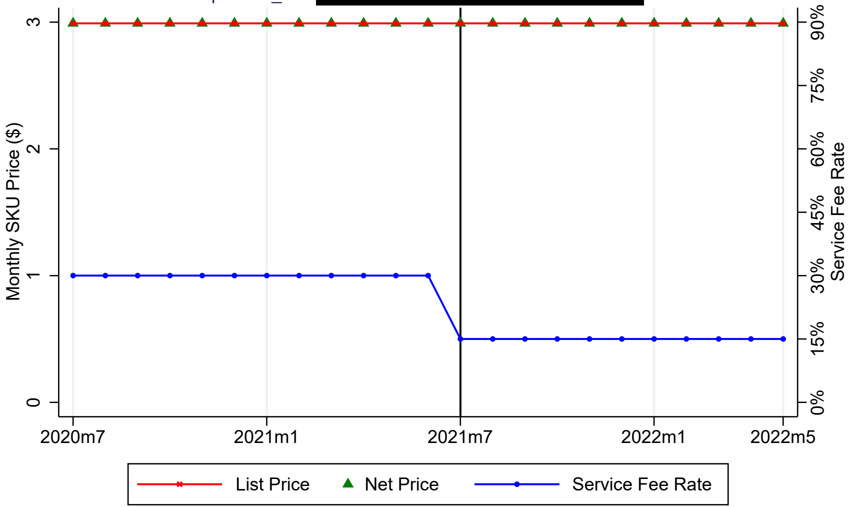
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 20.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 87% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 21.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 24.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category);
53% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 27.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 29.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

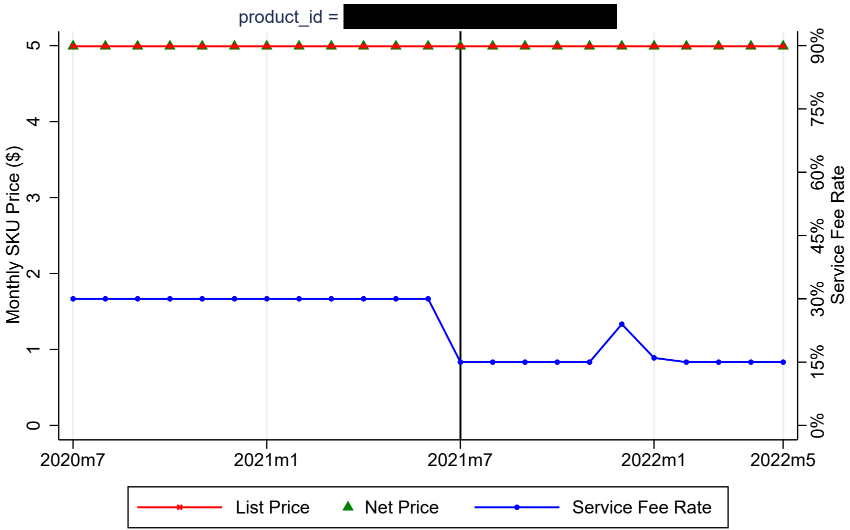
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 31.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 93% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 35.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]

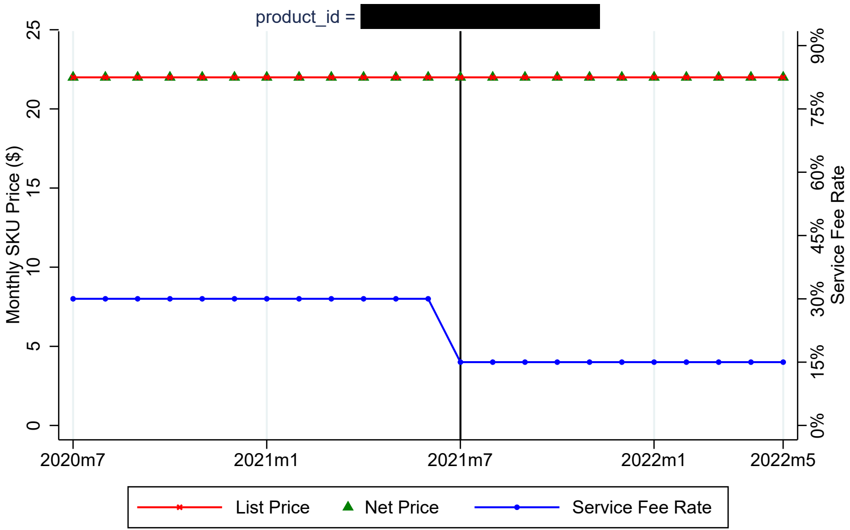
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 36.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 99% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 37.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 85% (for the corresponding app developer).

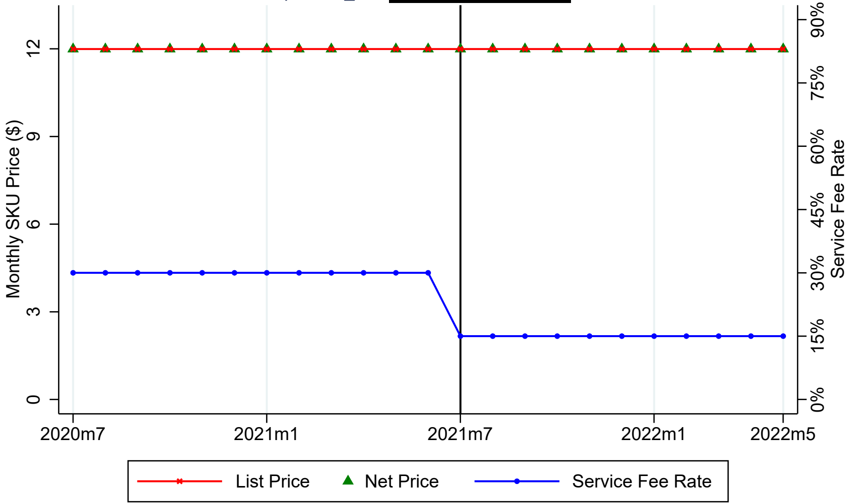
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 38.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).



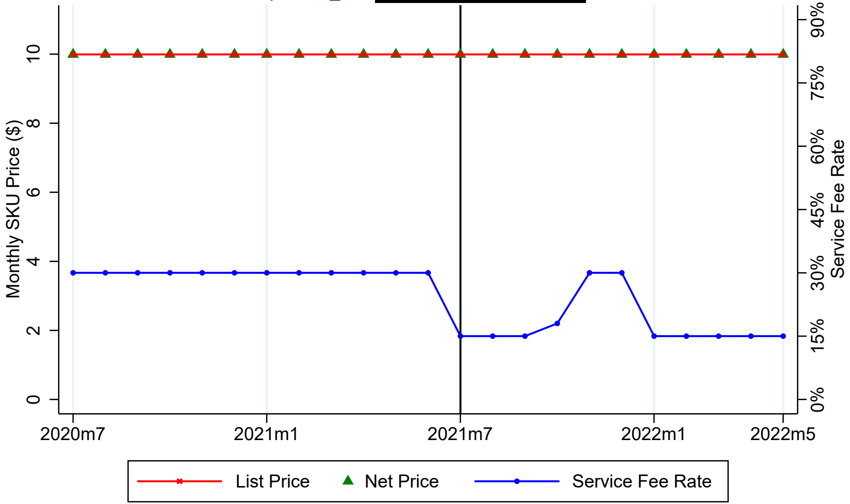
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 39.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

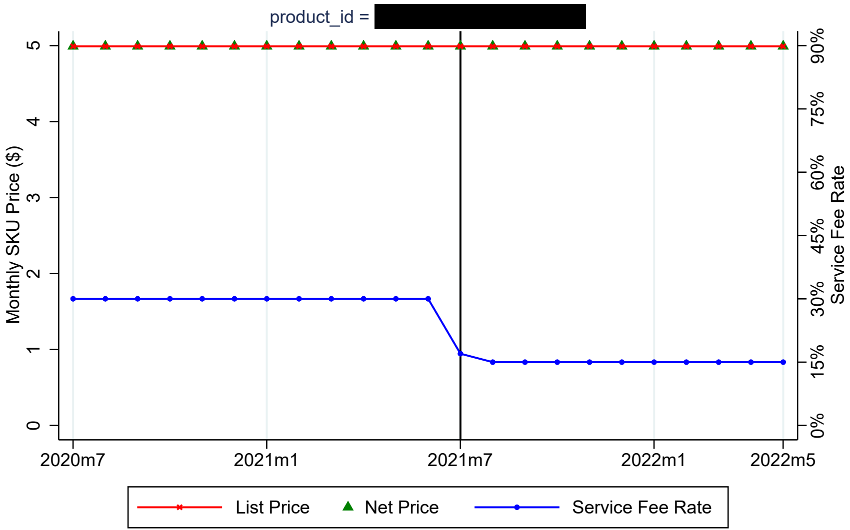


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 41.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]

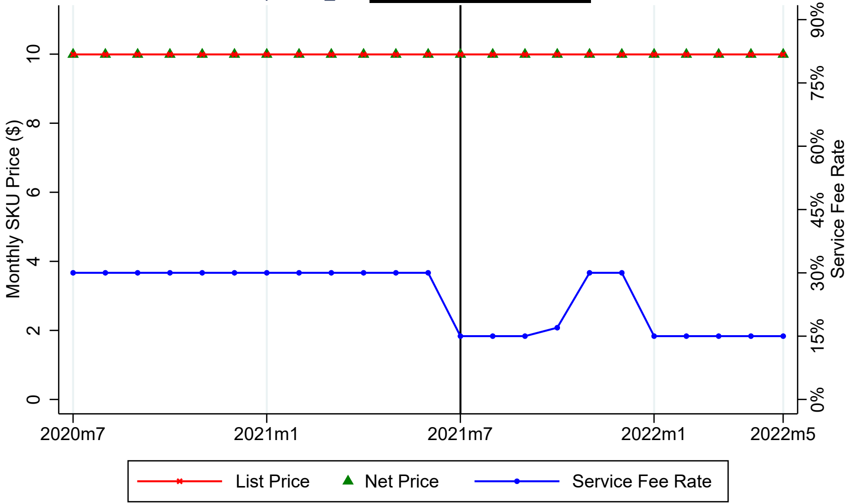


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 42.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 96% (for the corresponding app developer).



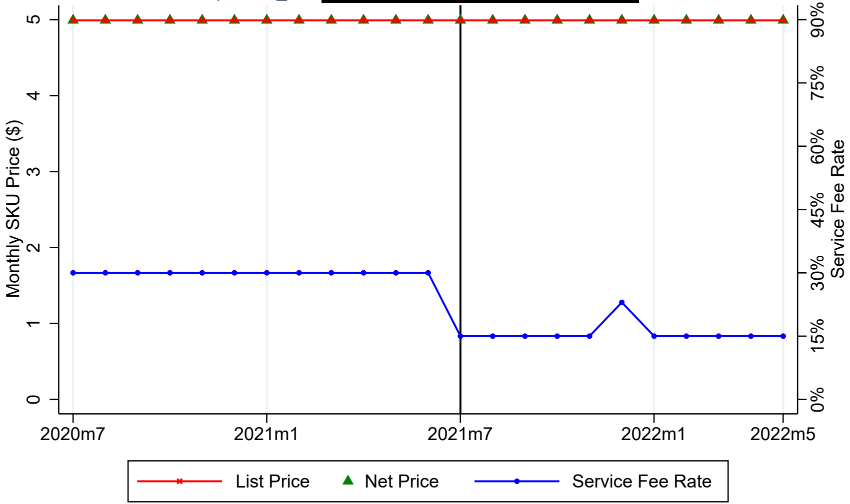
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 43.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 44.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 96% (for the corresponding app developer).

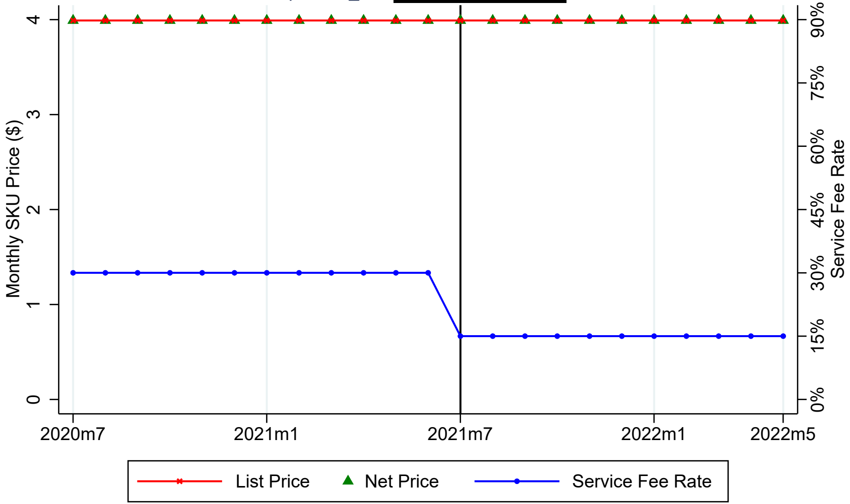
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 47.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category);
85% (for the corresponding app developer).

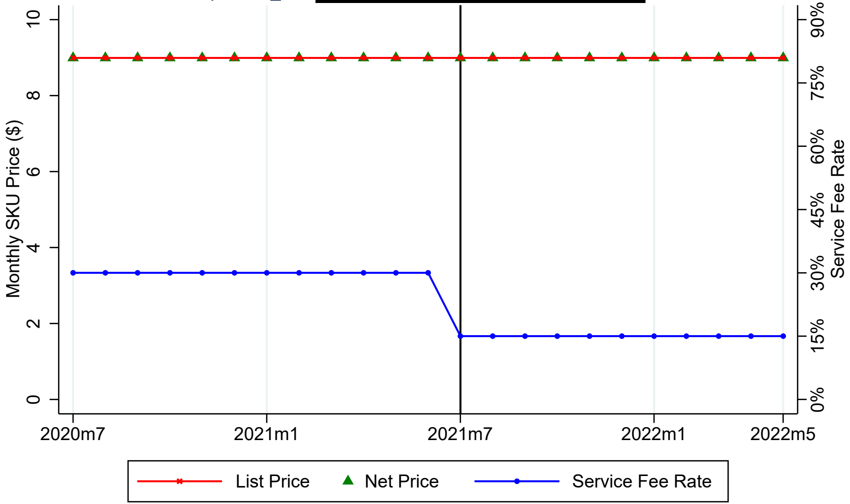
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 48.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]



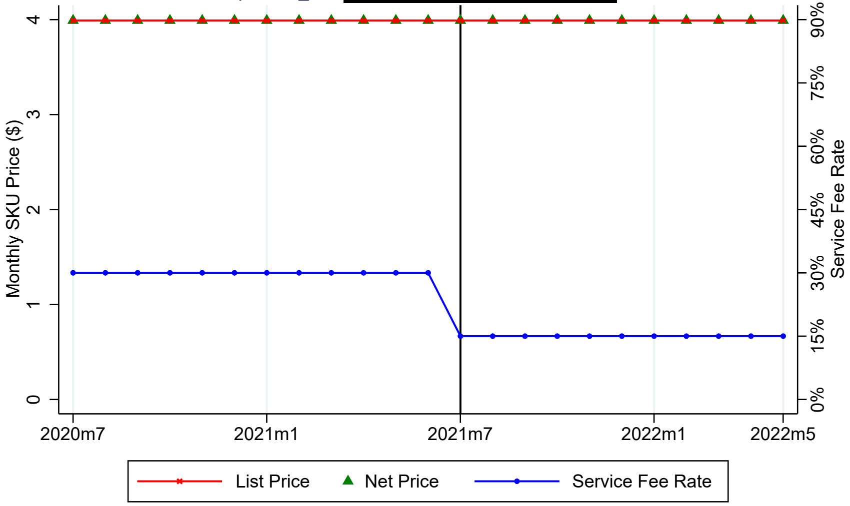
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 52.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category);
95% (for the corresponding app developer).

product_id = [redacted]



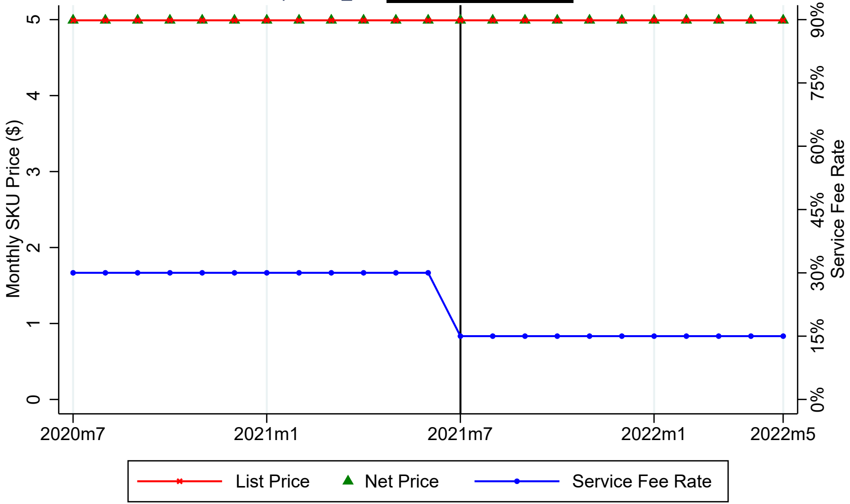
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 58.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 82% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]



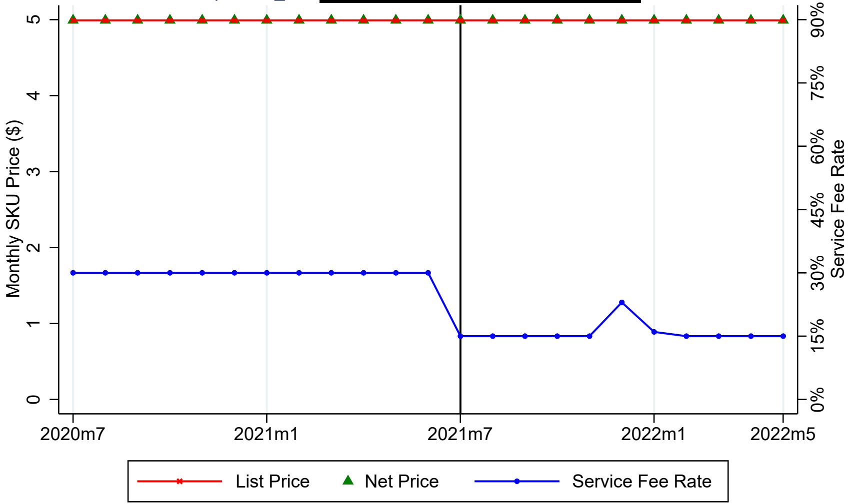
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 63.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 95% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 69.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 71.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 85% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 74.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 95% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 77.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 78.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 89% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 83.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 98% (for the corresponding app developer).

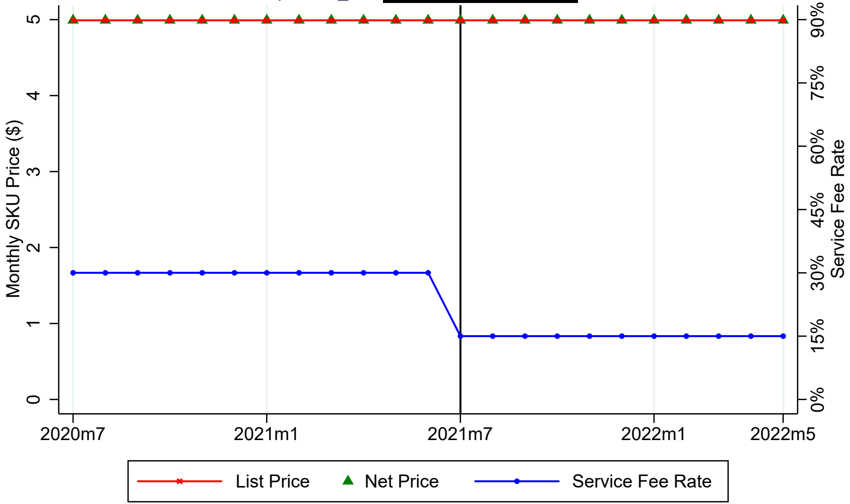
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 85.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]

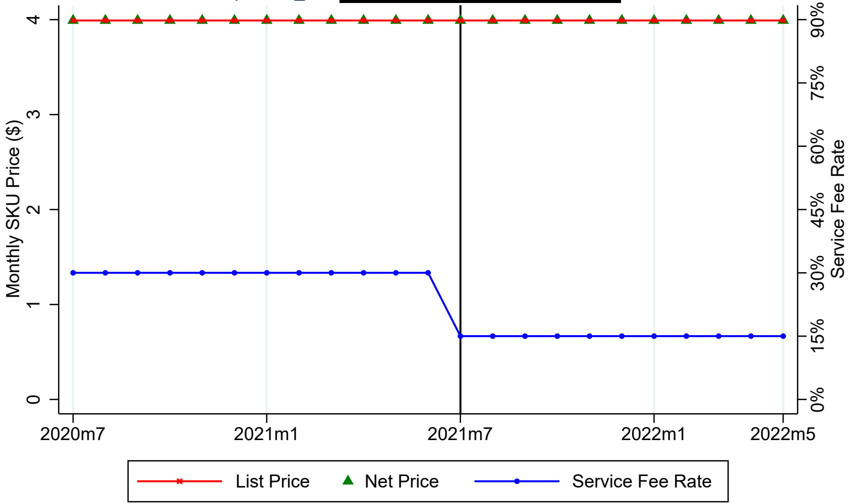
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 86.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]



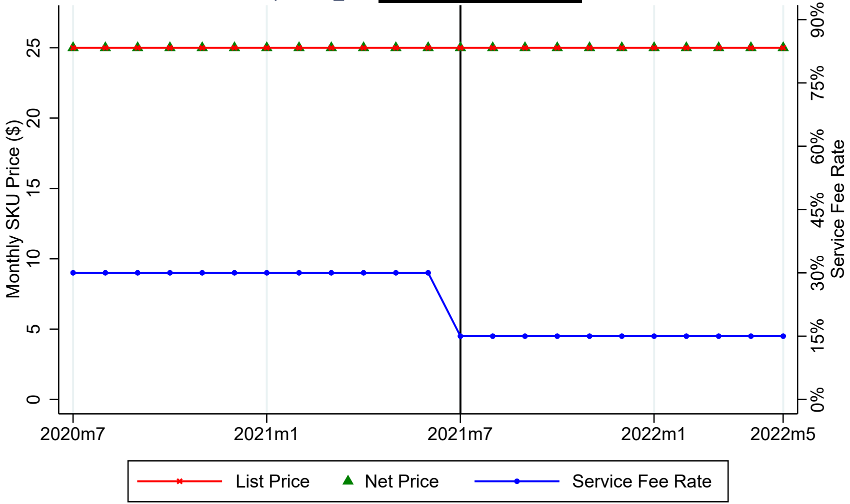
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 87.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]

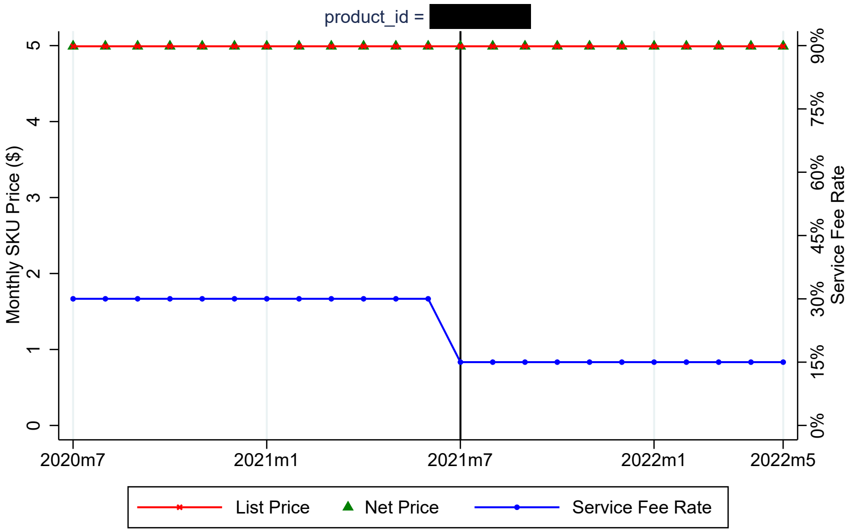


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 90.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 82% (for the corresponding app category); 66% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 92.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 100.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 62% (for the corresponding app category);
94% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 1.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 49% (for the corresponding app developer).

product_id = [redacted]

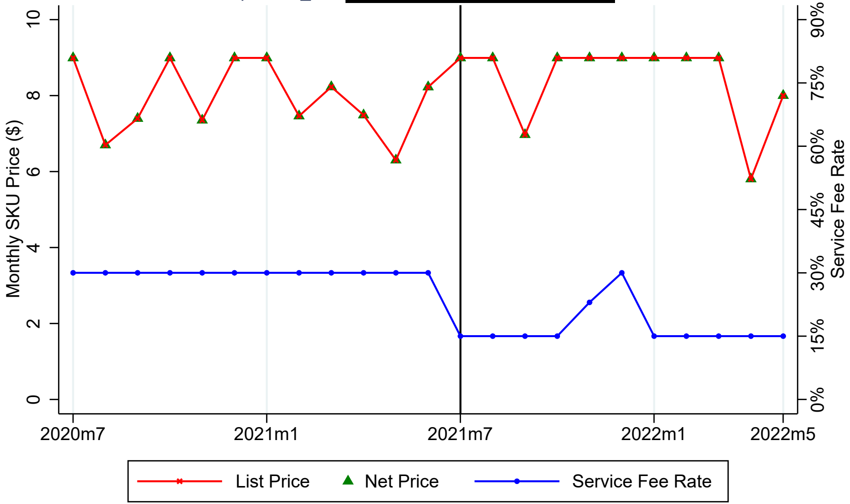
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 8.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 69% (for the corresponding app category); 55% (for the corresponding app developer).

product_id = [redacted]

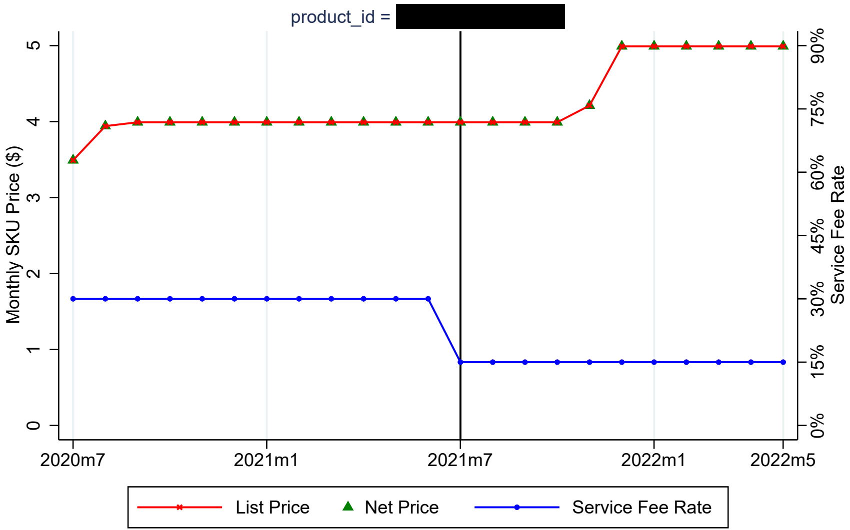
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 10.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 96% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 11.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 13.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 92% (for the corresponding app developer).

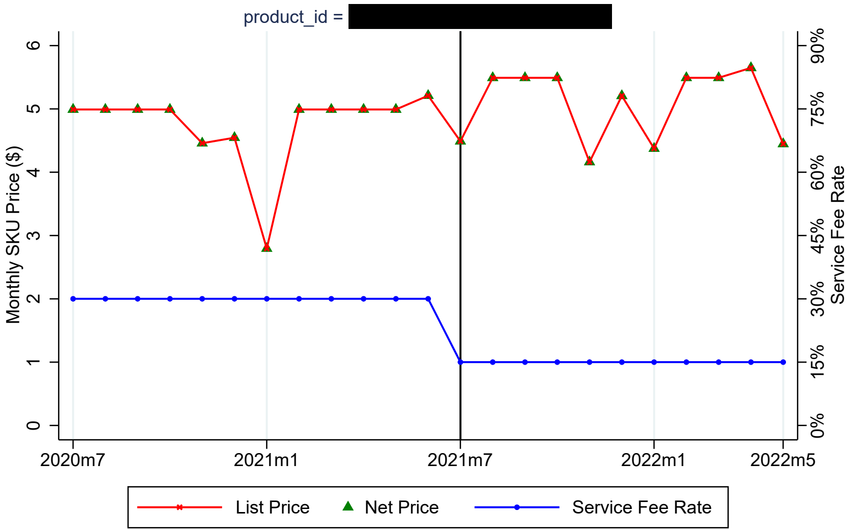


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 16.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 95% (for the corresponding app category); 88% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 19.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

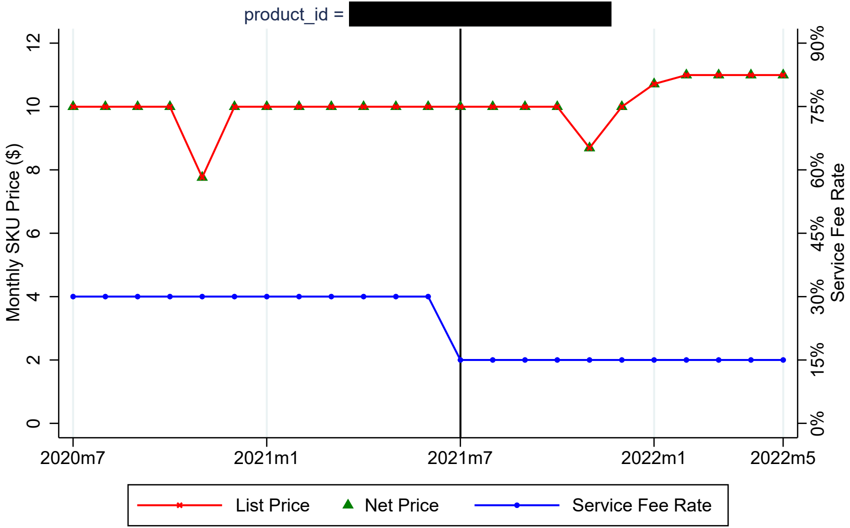
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 22.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 49% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 23.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 26.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 97% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 28.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 30.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 49% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 32.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

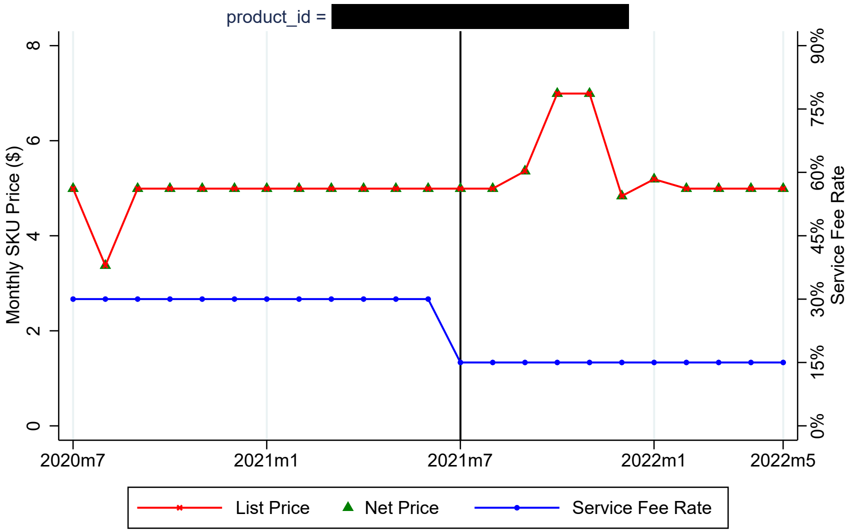
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 33.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 34.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 85% (for the corresponding app developer).

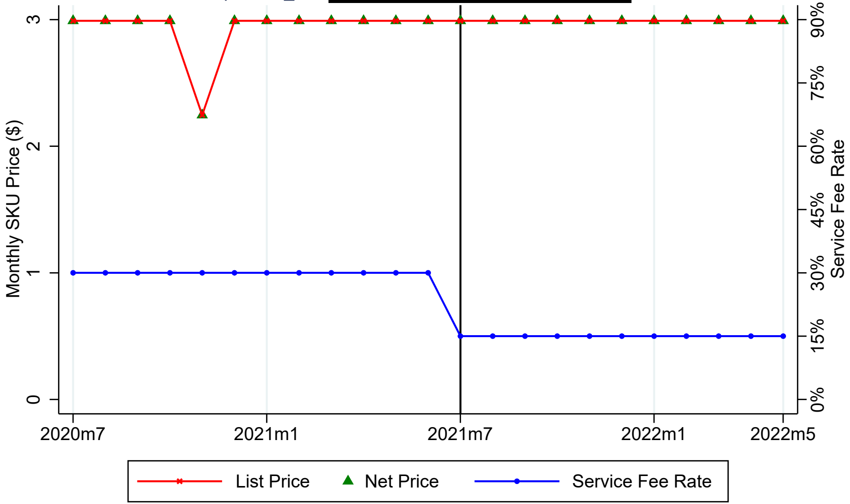
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 40.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 68% (for the corresponding app category); 92% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 45.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 87% (for the corresponding app developer).

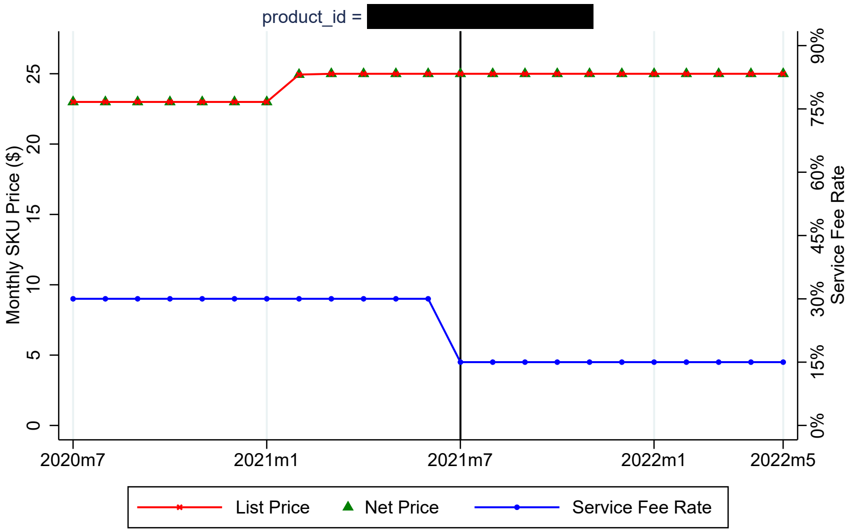
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 46.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category);
93% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 49.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category);
94% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 50.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 54.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 55.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category);
97% (for the corresponding app developer).

product_id = [redacted]

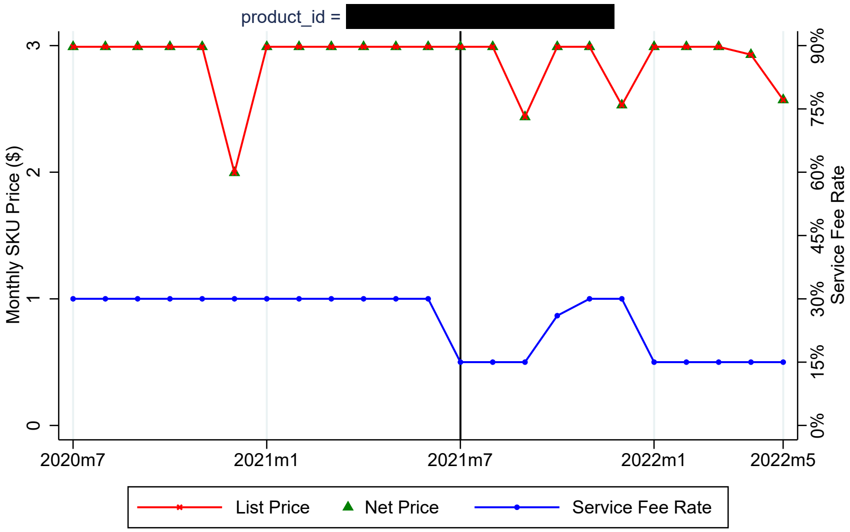
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 59.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 51% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]

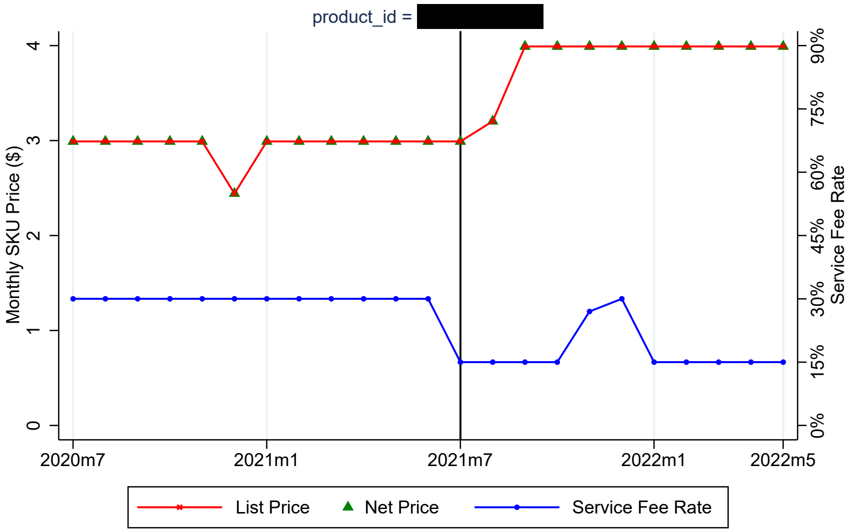
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 60.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

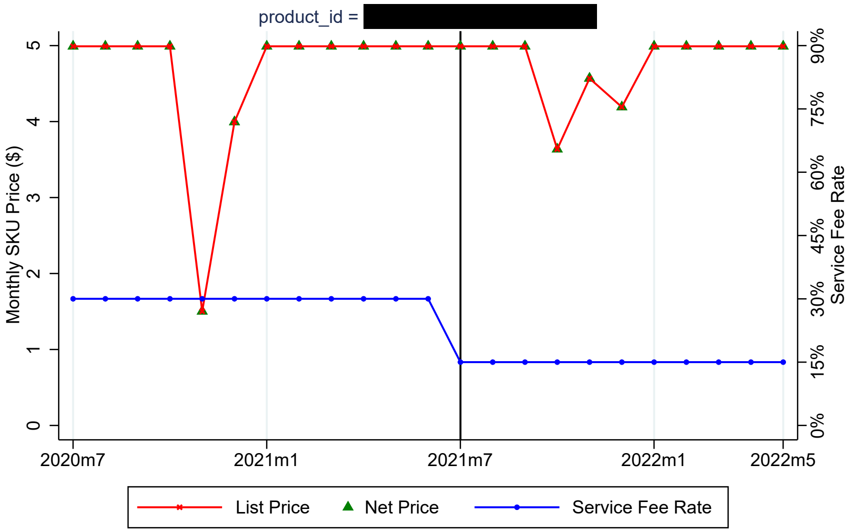
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 61.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 90% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 65.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 90% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 68.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 94% (for the corresponding app developer).

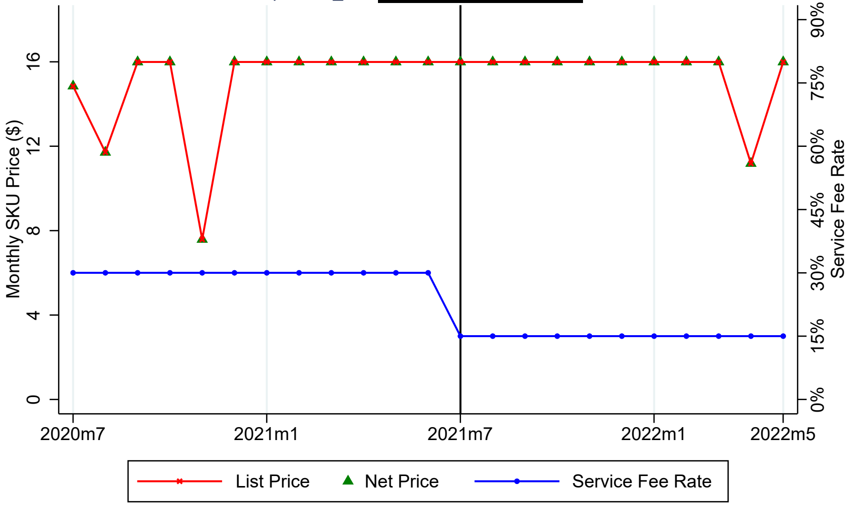


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 70.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 73.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 76.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

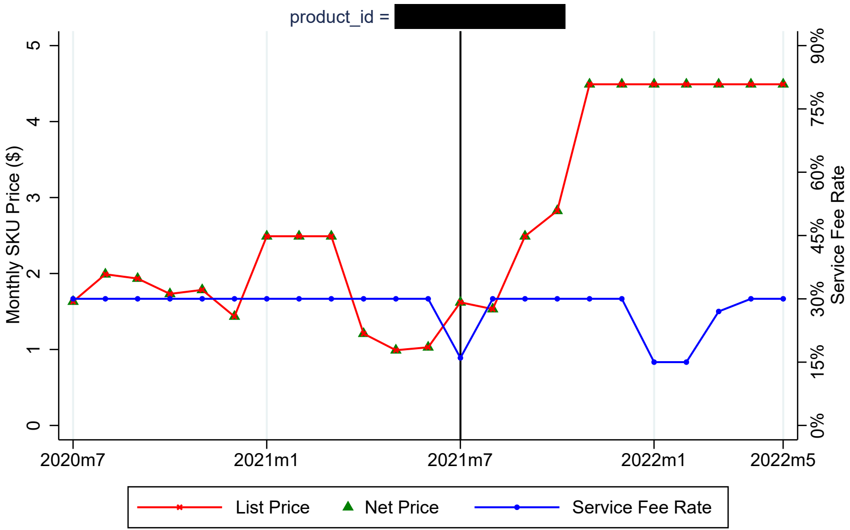
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 79.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 62% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 81.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 94% (for the corresponding app developer).

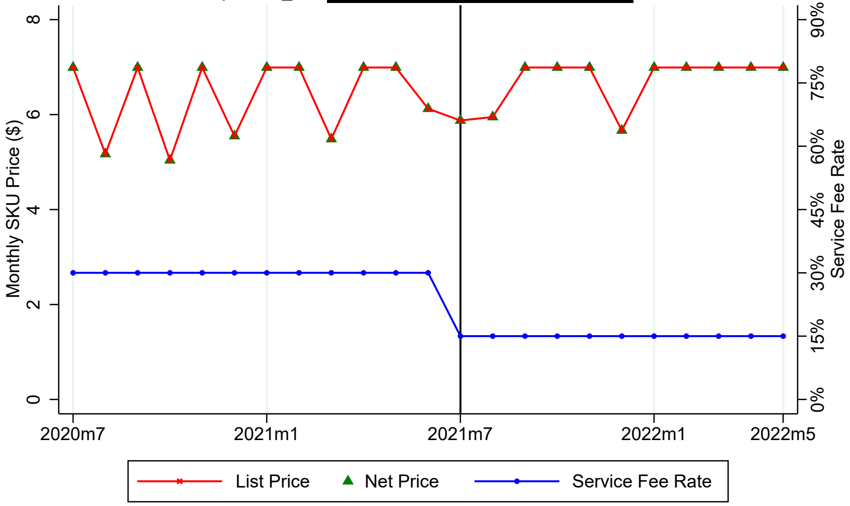
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 82.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 93% (for the corresponding app developer).



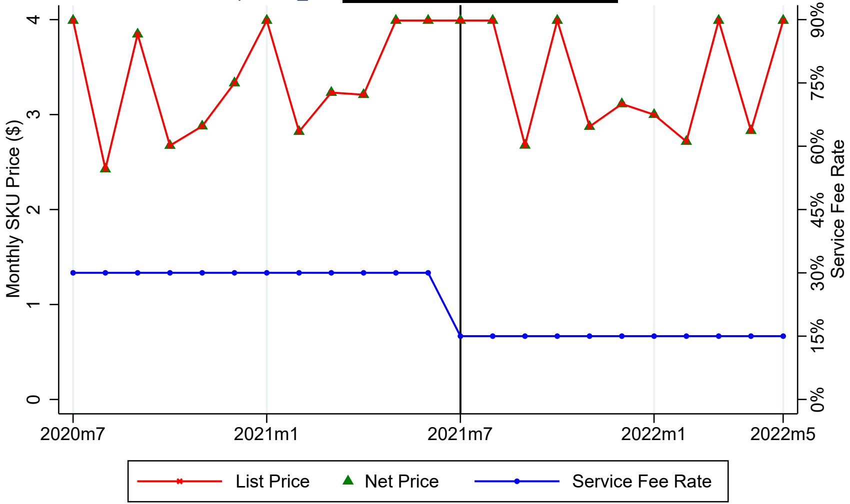
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 84.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]

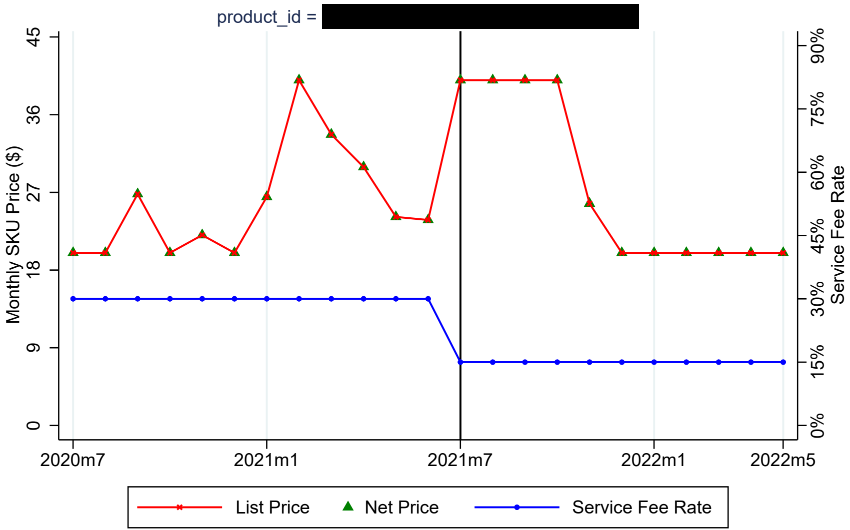


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 89.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category);
98% (for the corresponding app developer).

product_id = [redacted]

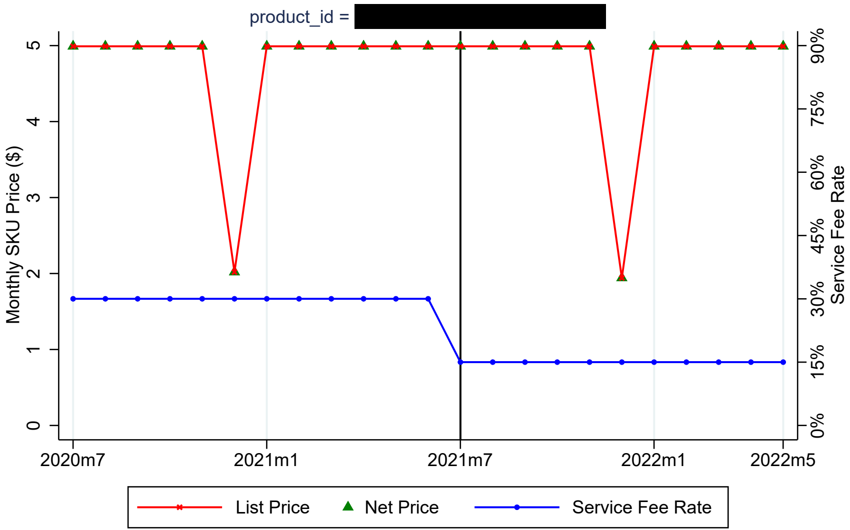


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 93.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 98% (for the corresponding app developer).



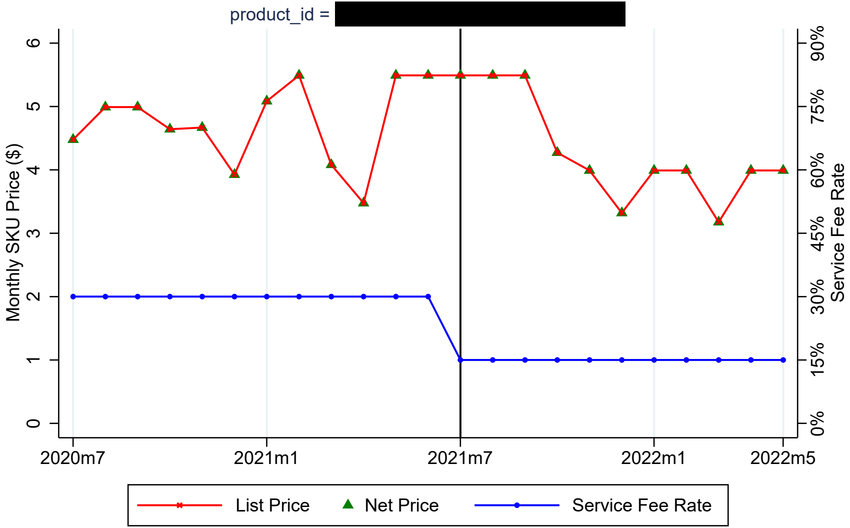
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 99.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 98% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 6.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 49% (for the corresponding app developer).

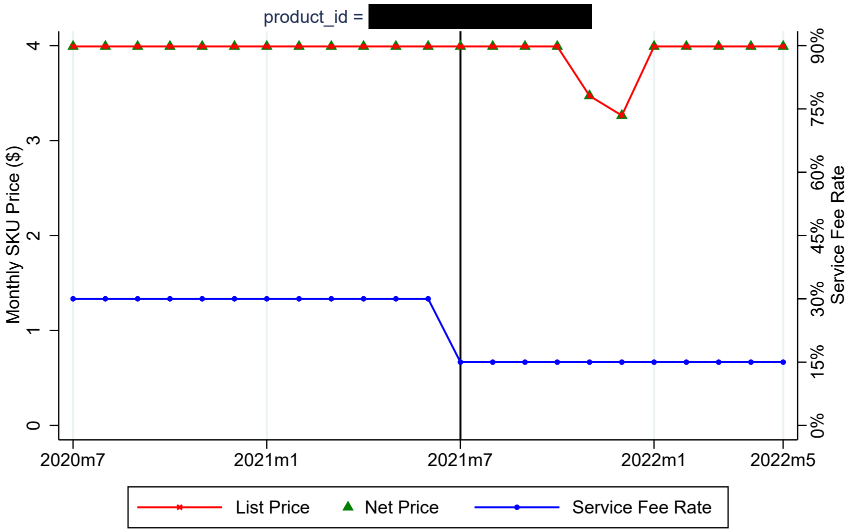


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 12.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 87% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 14.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 96% (for the corresponding app developer).

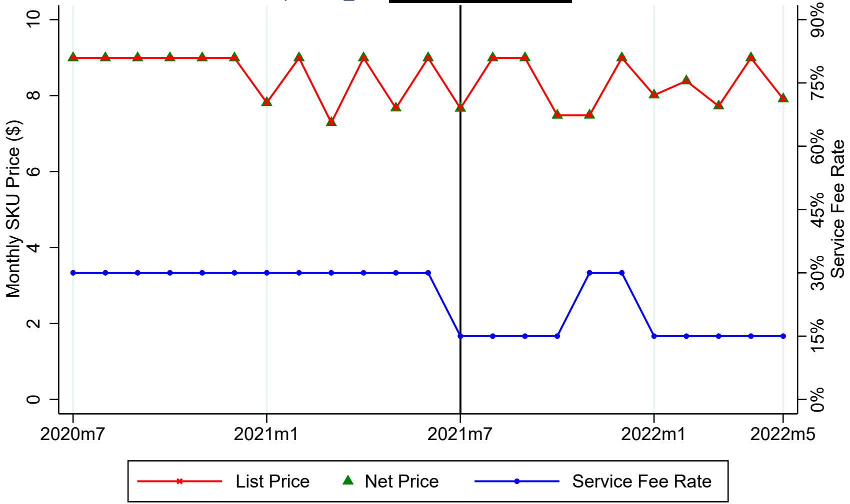


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 25.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 97% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 51.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 53.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 71% (for the corresponding app developer).

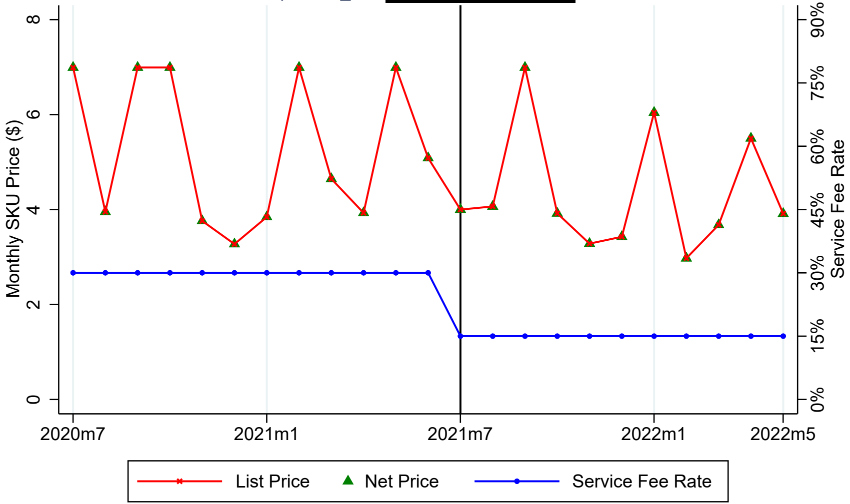
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 56.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 92% (for the corresponding app developer).

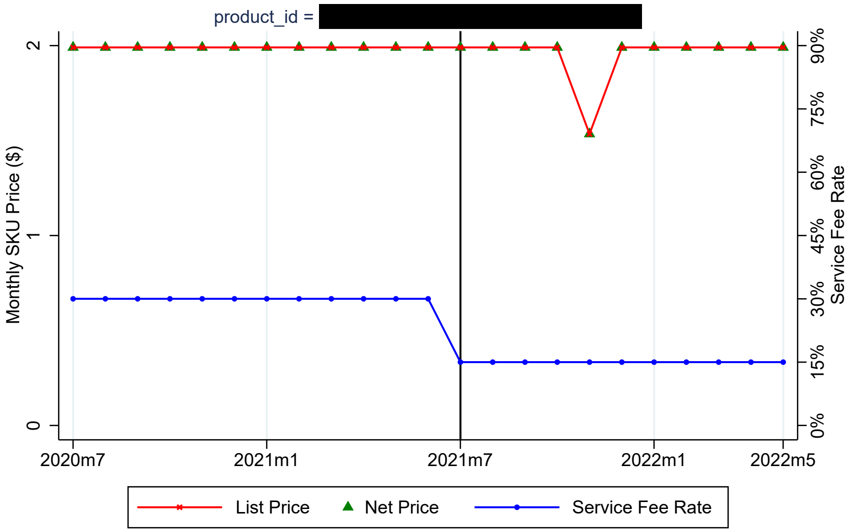
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 57.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 62.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category);
92% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 64.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category);
85% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 66.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category);
94% (for the corresponding app developer).

product_id = [redacted]

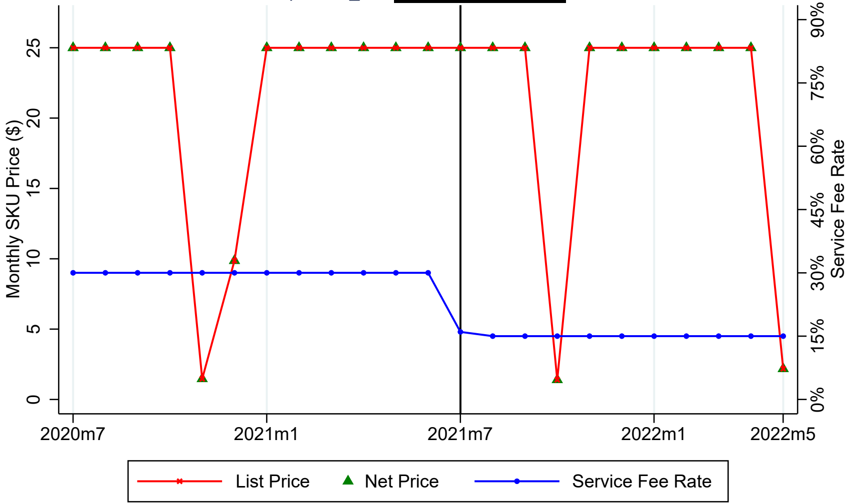
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 67.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 97% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 72.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 75.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 80.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 93% (for the corresponding app category); 62% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 88.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

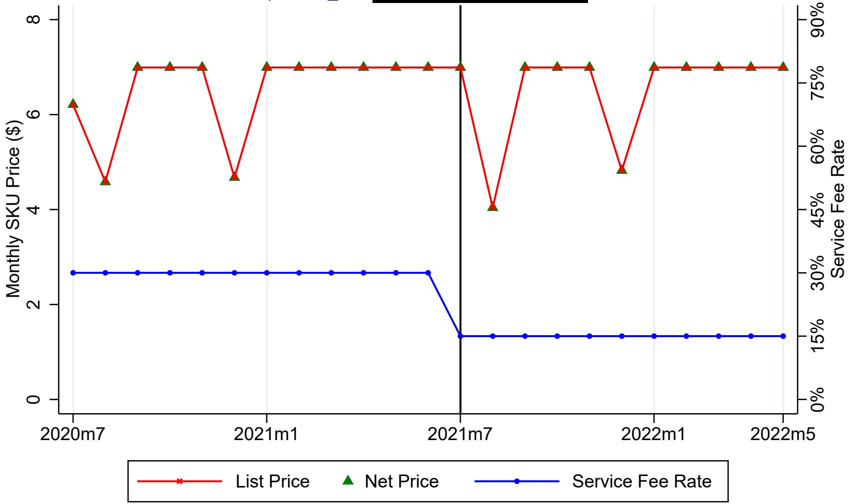
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 91.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 94.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 98% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 95.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 91% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 96.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 97.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category);
93% (for the corresponding app developer).

product_id = [redacted]

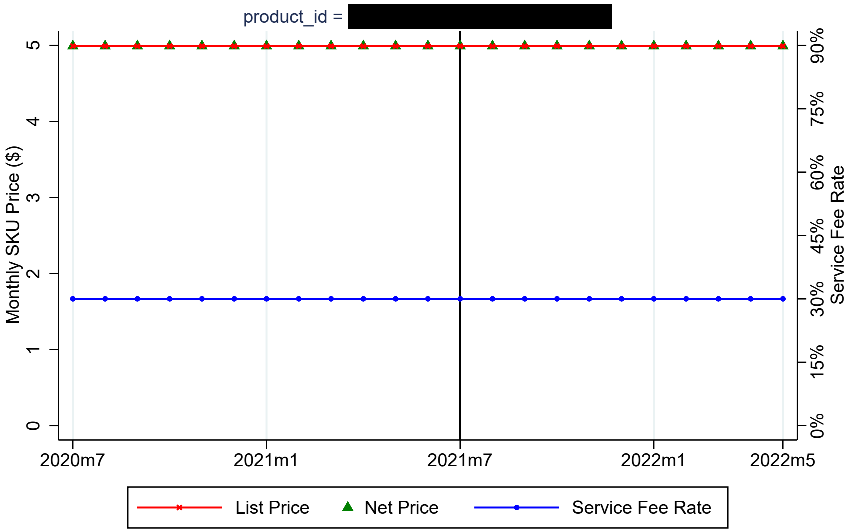
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 98.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 92% (for the corresponding app developer).

Exhibit 35c

Average Monthly Product Price and Service Fee Rate for the Top 100 Paid Apps

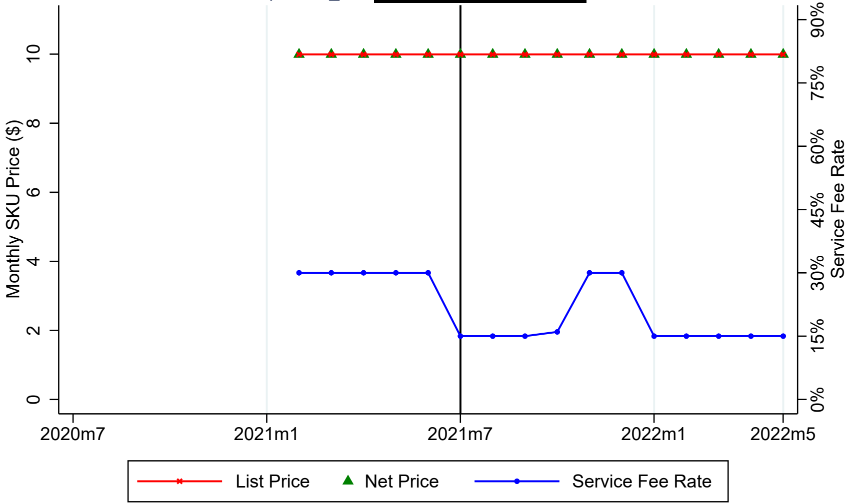
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 3.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 88% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 6.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]



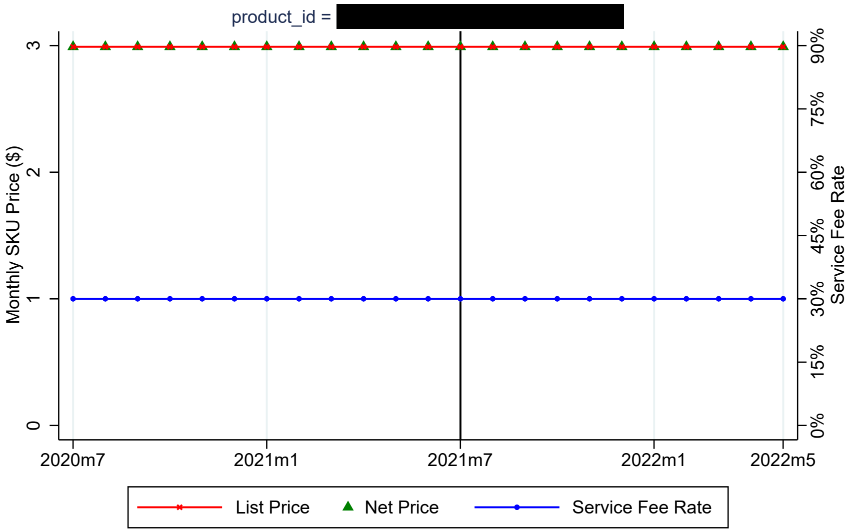
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 7.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 71% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 8.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 9.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 82% (for the corresponding app developer).



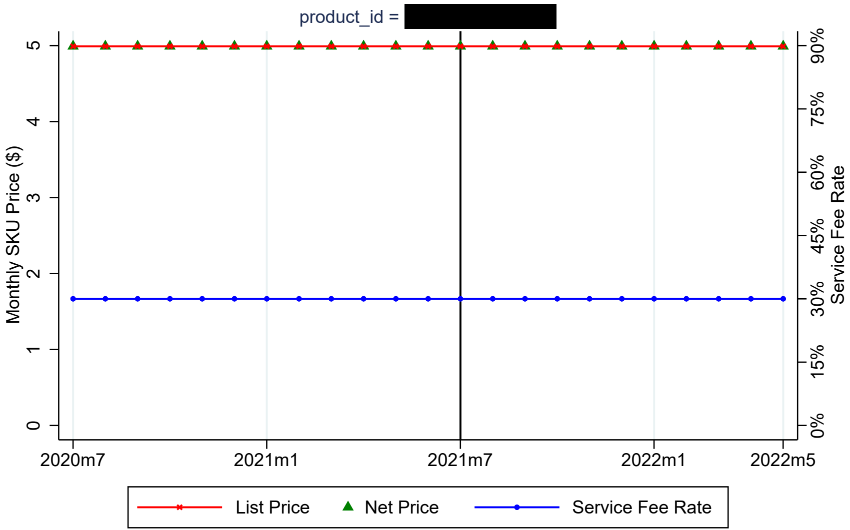
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 10.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 79% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 11.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 90% (for the corresponding app developer).

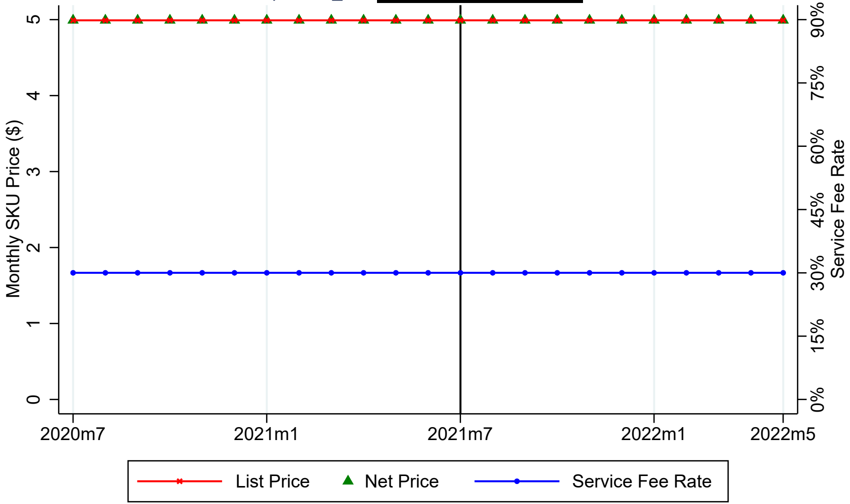
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 12.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).



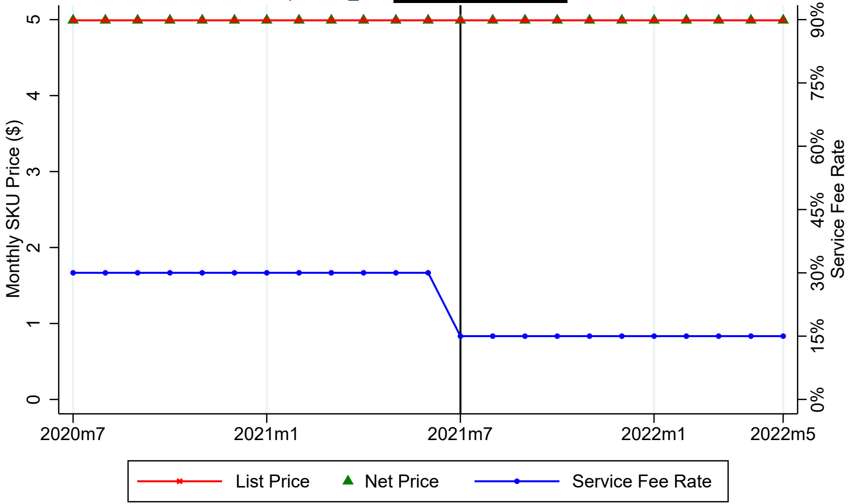
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 13.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 16.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 88% (for the corresponding app developer).

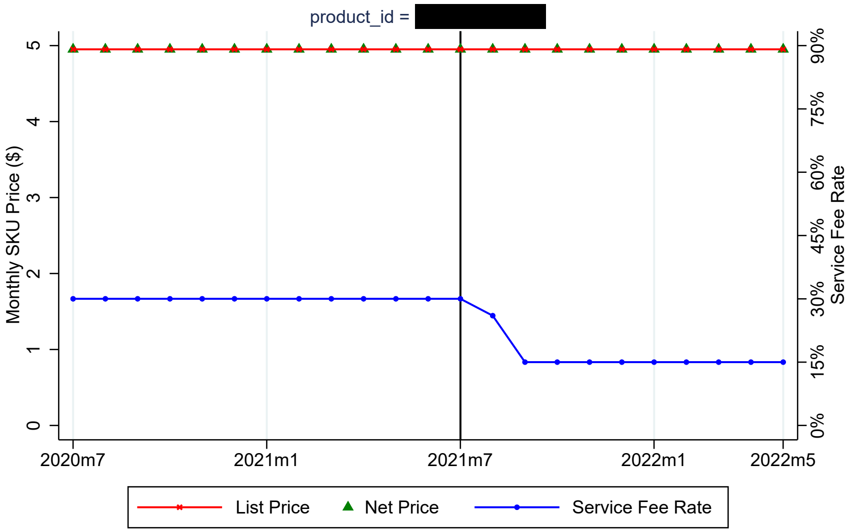
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 18.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

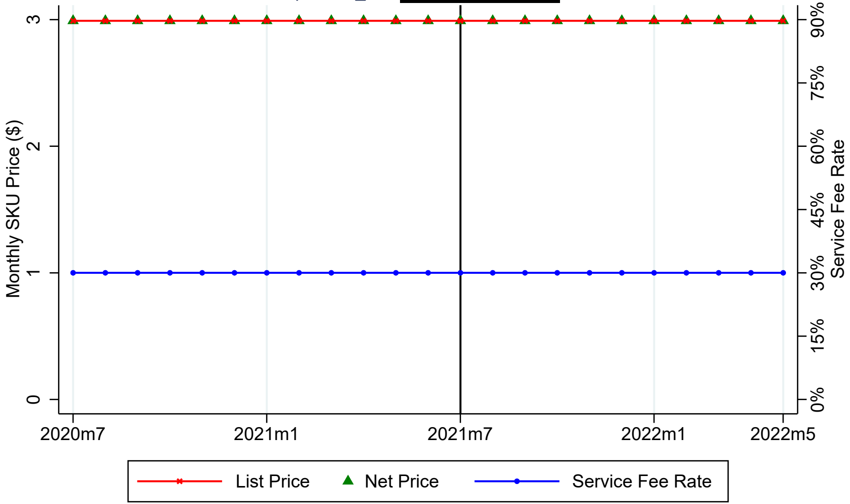
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 21.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 62% (for the corresponding app category); 80% (for the corresponding app developer).



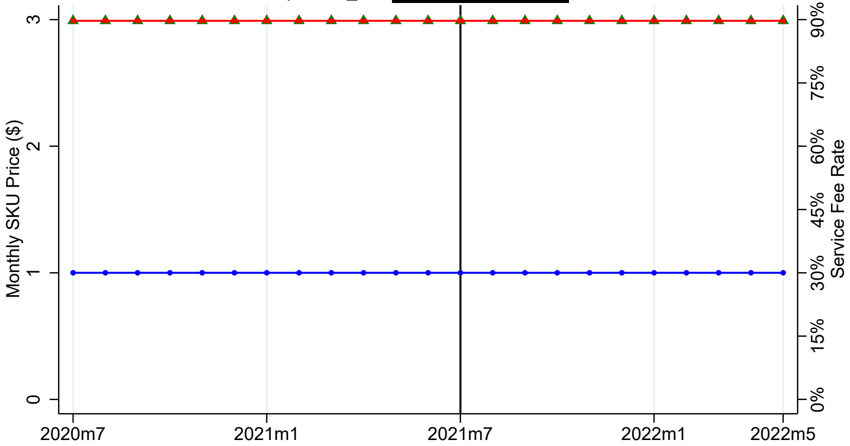
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 22.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category);
78% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 23.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 82% (for the corresponding app developer).

product_id = [redacted]



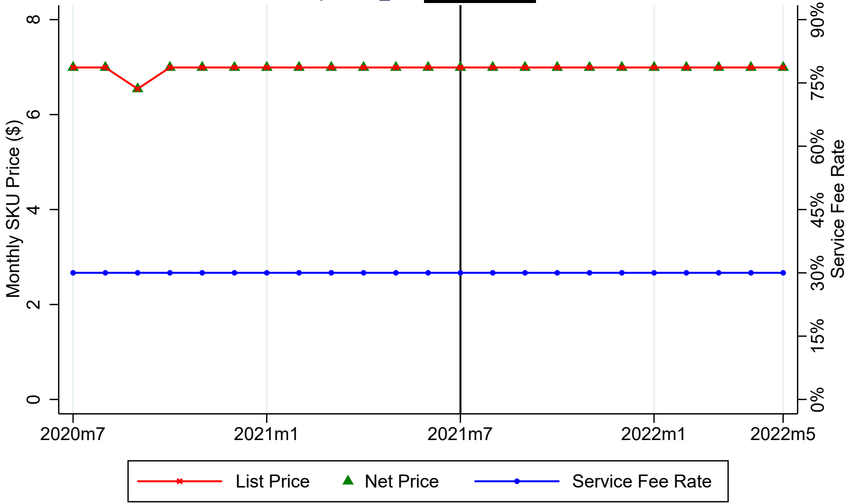
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 25.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 79% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 28.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 26% (for the corresponding app developer).

product_id = [redacted]

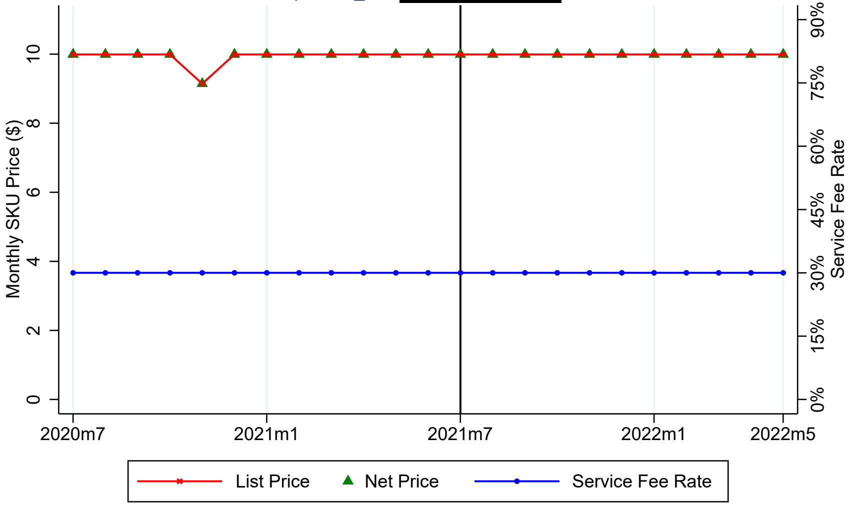
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 33.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]



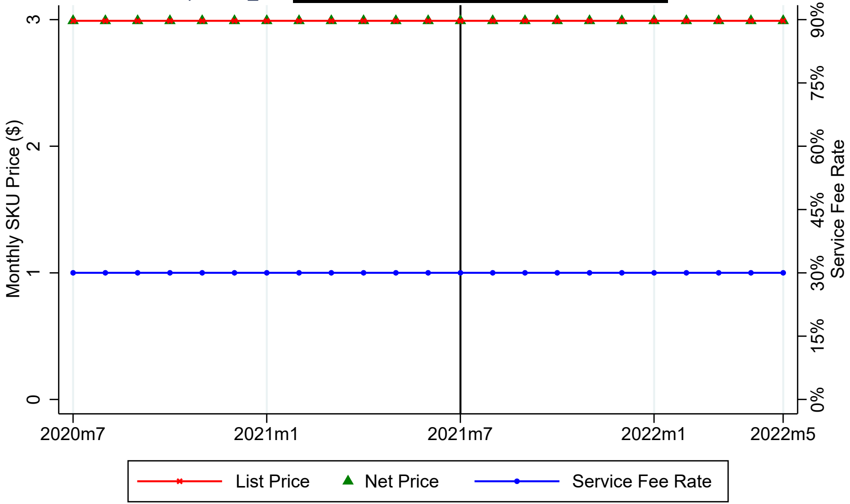
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 34.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 94% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 35.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 97% (for the corresponding app developer).

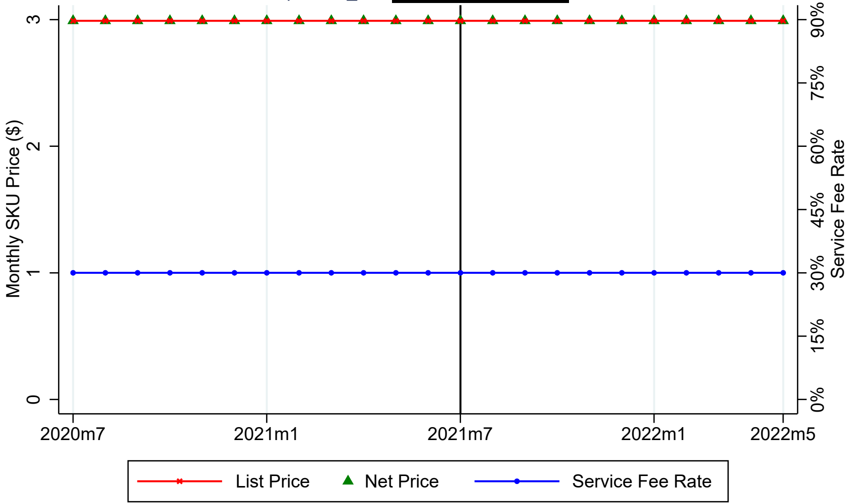
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 38.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 79% (for the corresponding app developer).

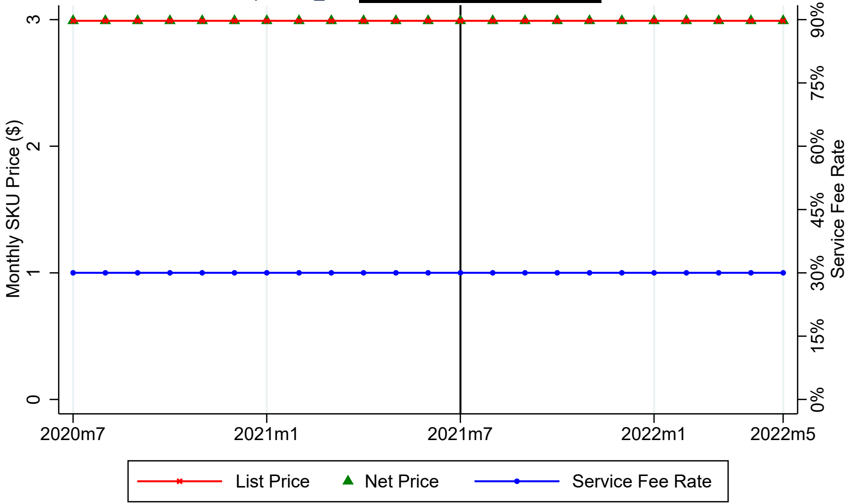
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 39.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

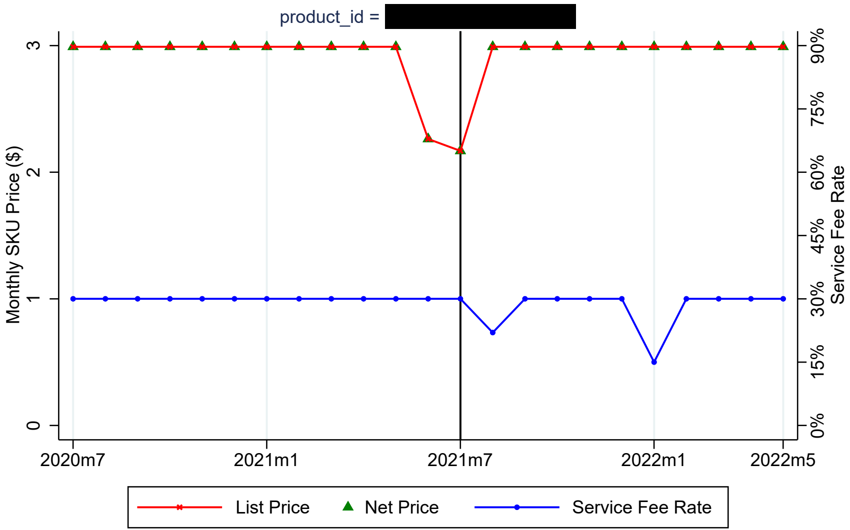


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 40.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category);
79% (for the corresponding app developer).

product_id = [redacted]

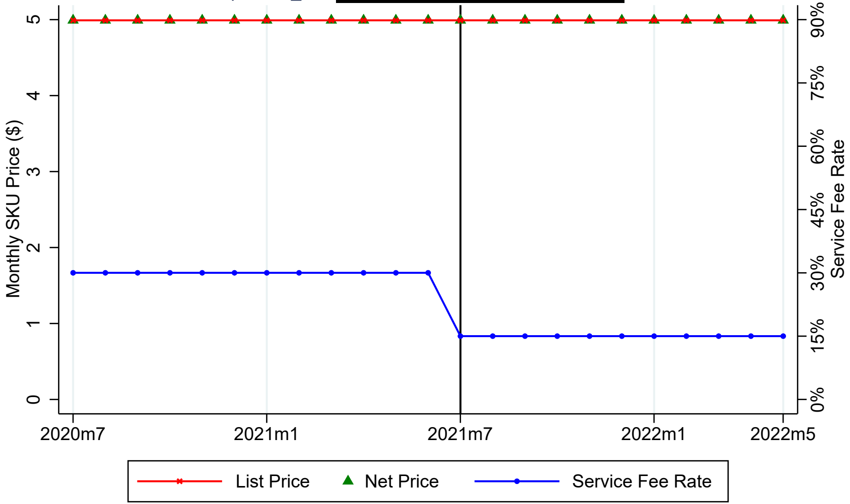


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 42.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 79% (for the corresponding app developer).

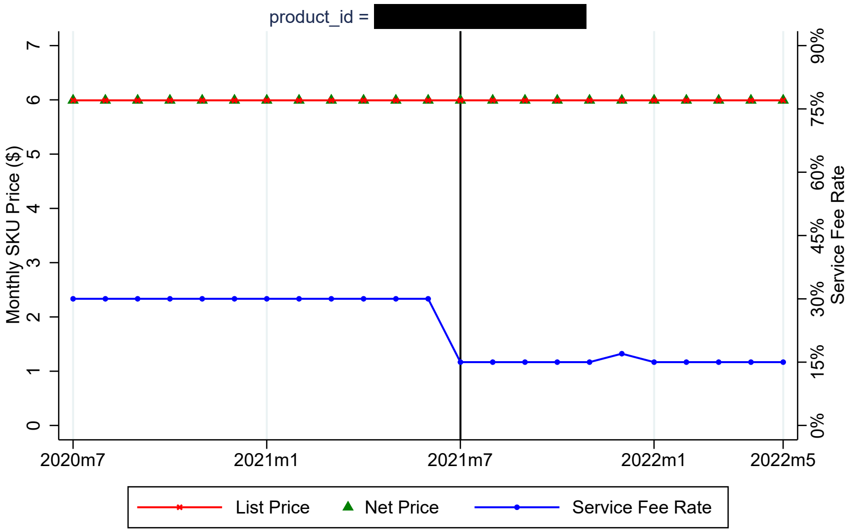


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 44.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category);
88% (for the corresponding app developer).

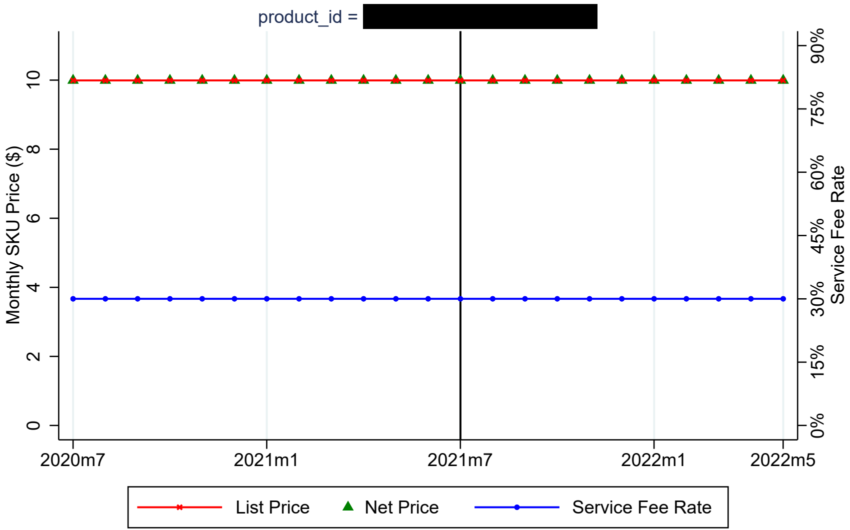
product_id = [redacted]



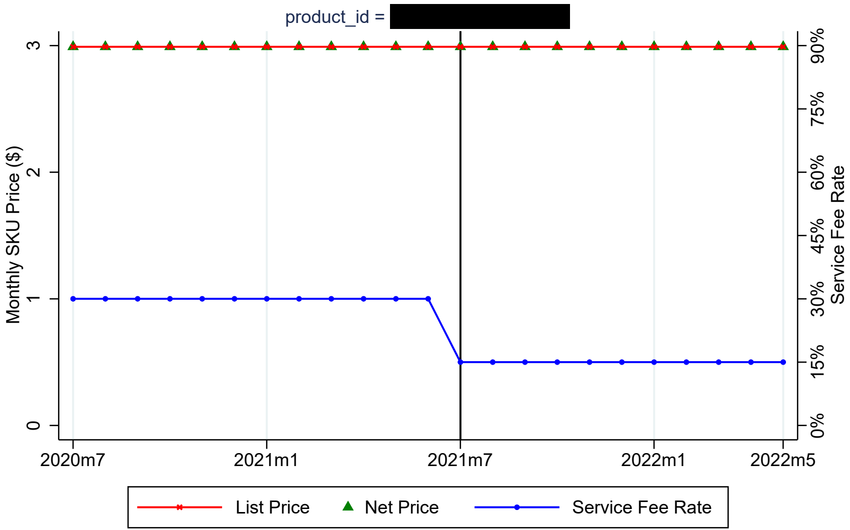
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 45.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 95% (for the corresponding app category); 82% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 47.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 98% (for the corresponding app developer).

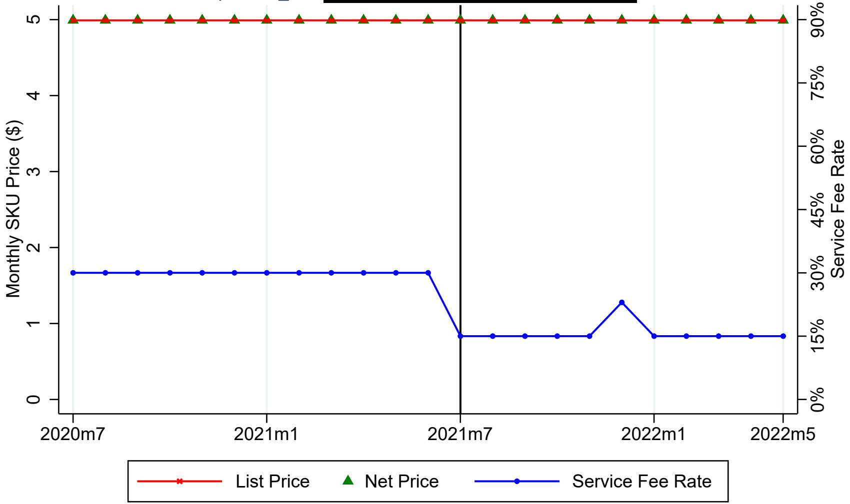


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 49.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 82% (for the corresponding app category); 91% (for the corresponding app developer).



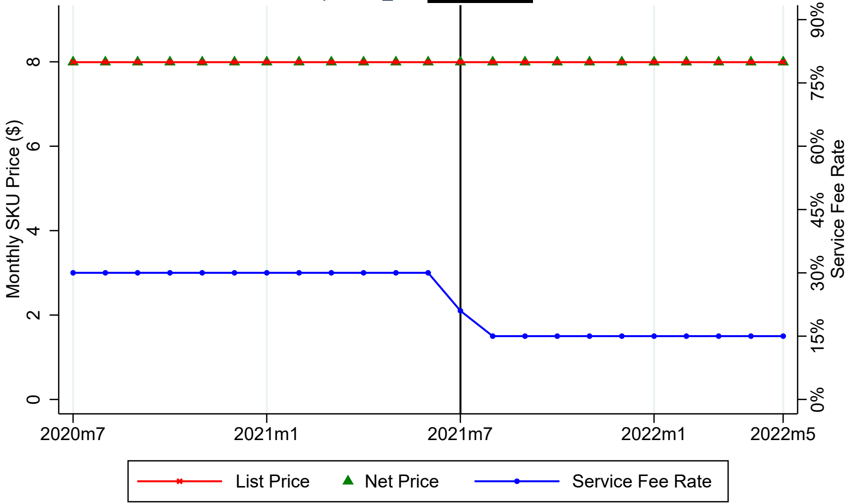
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 50.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category);
87% (for the corresponding app developer).

product_id = [redacted]



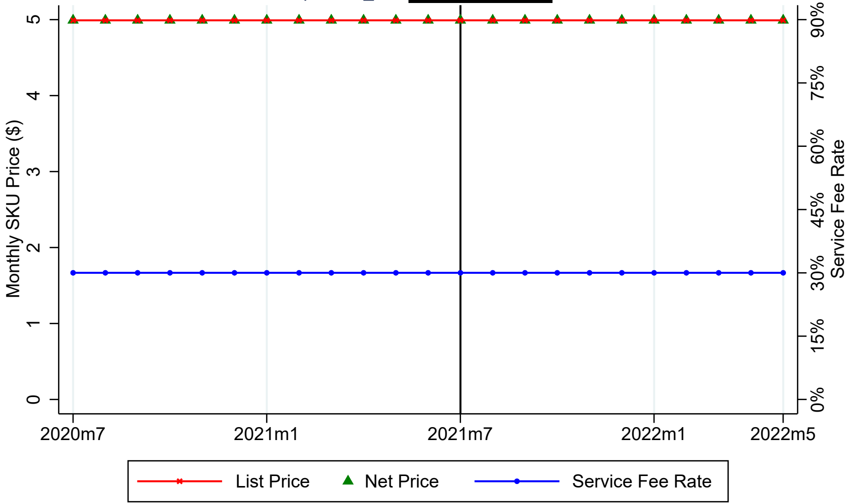
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 51.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]



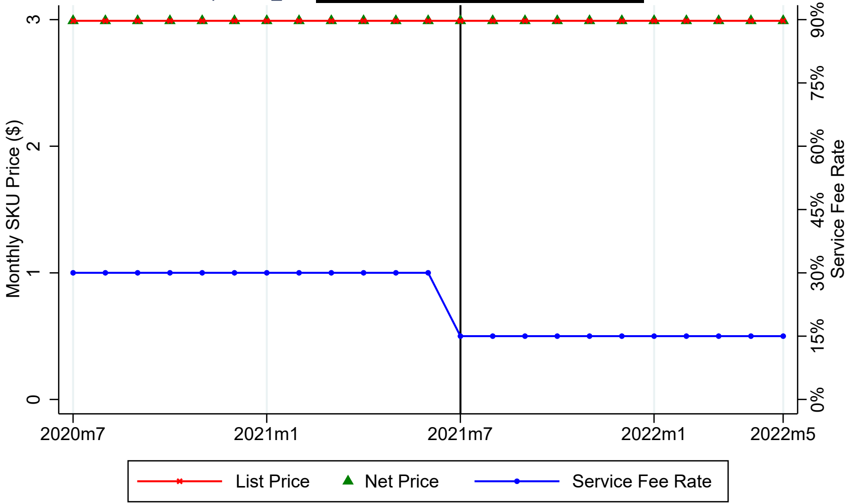
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 52.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 73% (for the corresponding app developer).

product_id = [redacted]

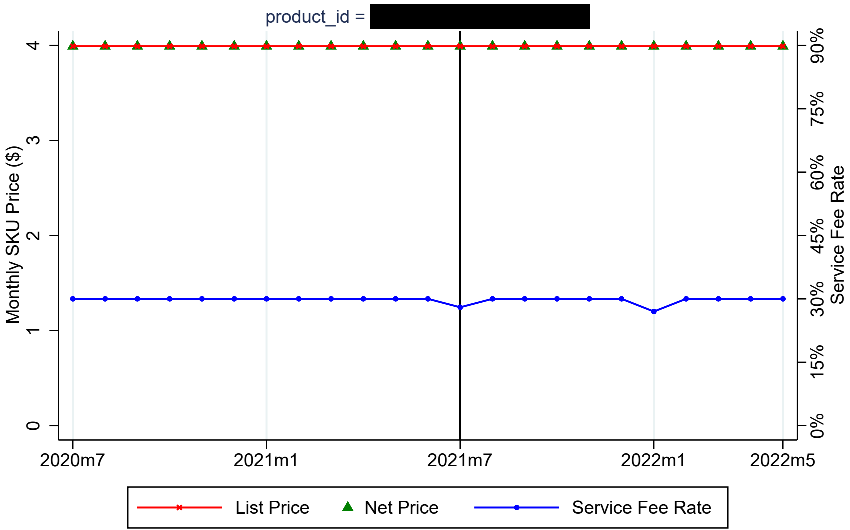


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 55.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]

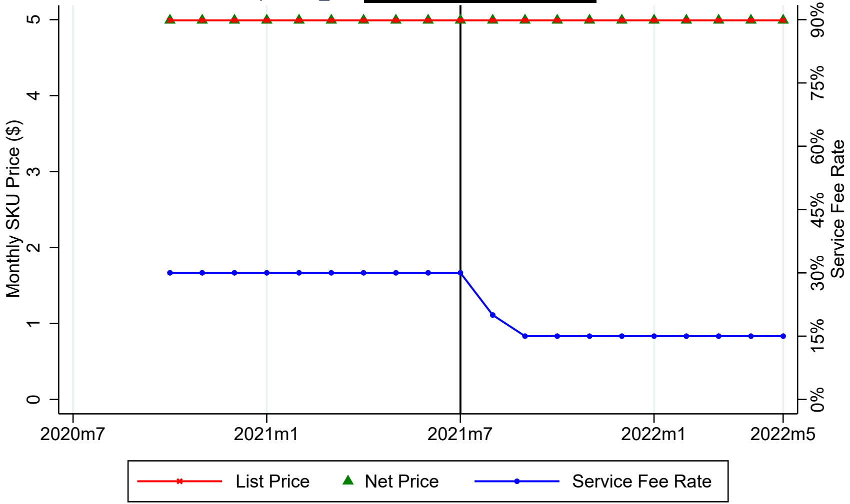


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 57.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 53% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 59.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 26% (for the corresponding app developer).

product_id = [redacted]



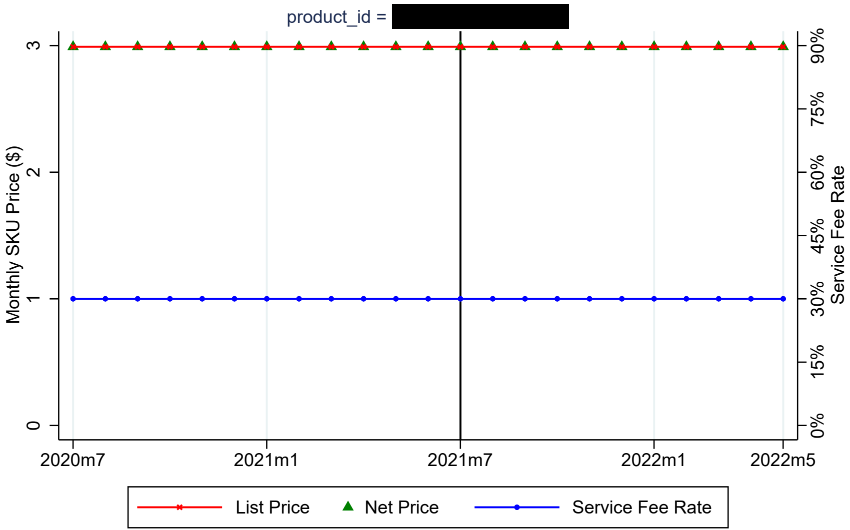
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 60.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category);
97% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 64.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 67.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 68.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 79% (for the corresponding app developer).

product_id = [redacted]

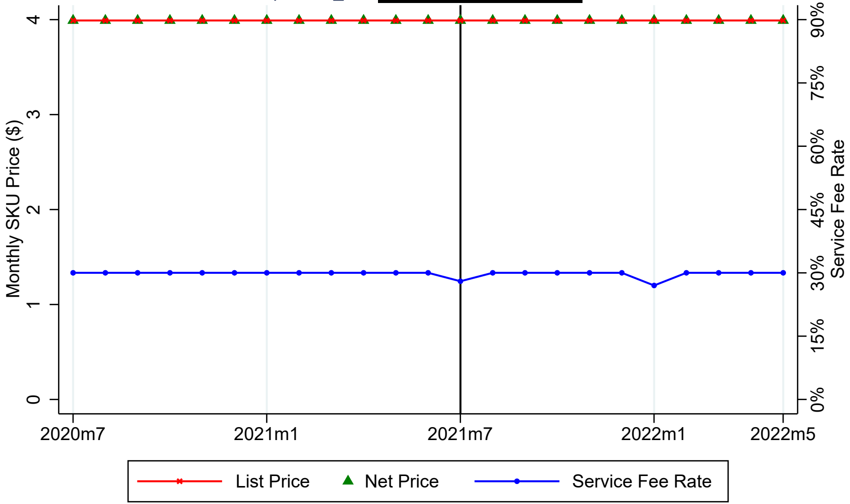
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 70.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]

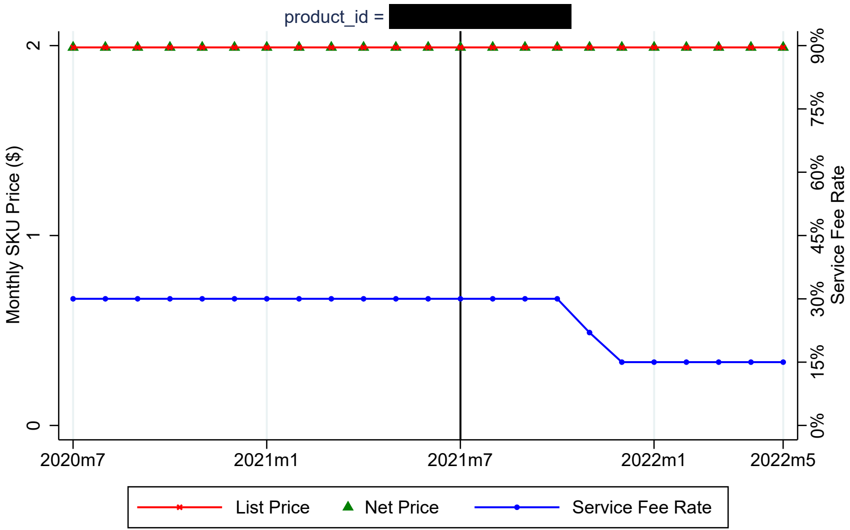
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 72.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 93% (for the corresponding app category); 88% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 73.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

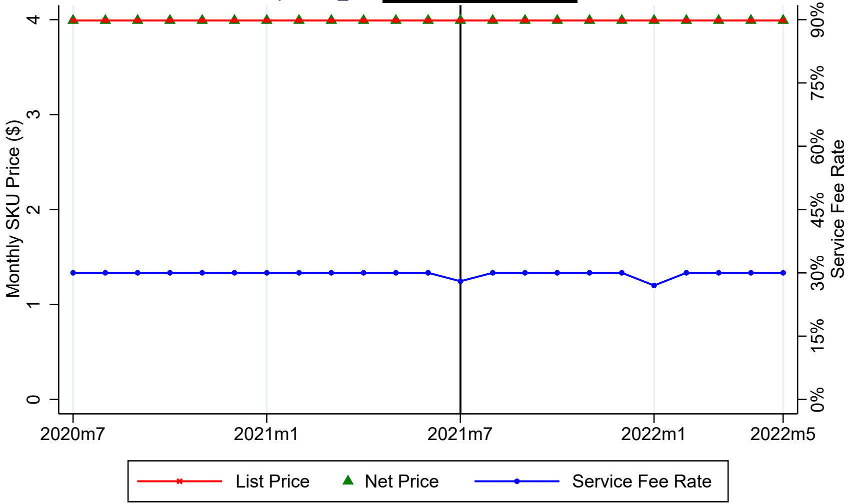


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 75.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 26% (for the corresponding app developer).

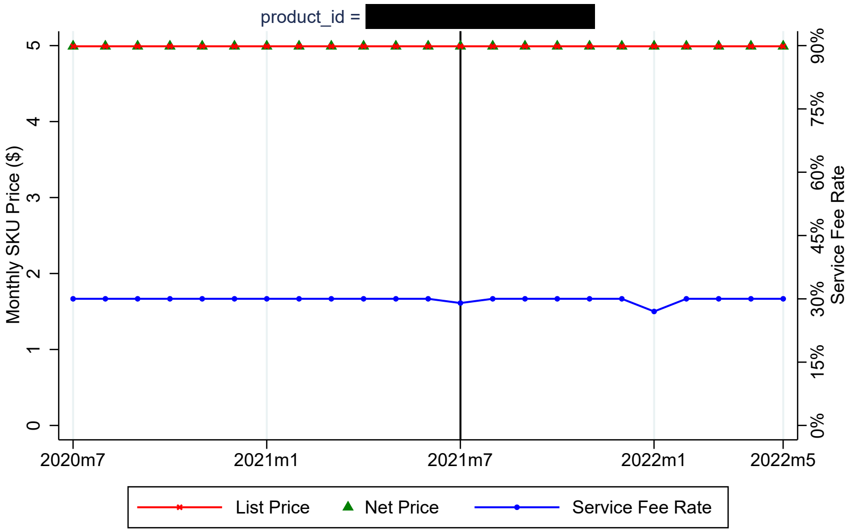


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 76.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 78.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category);
26% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 79.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category);
90% (for the corresponding app developer).

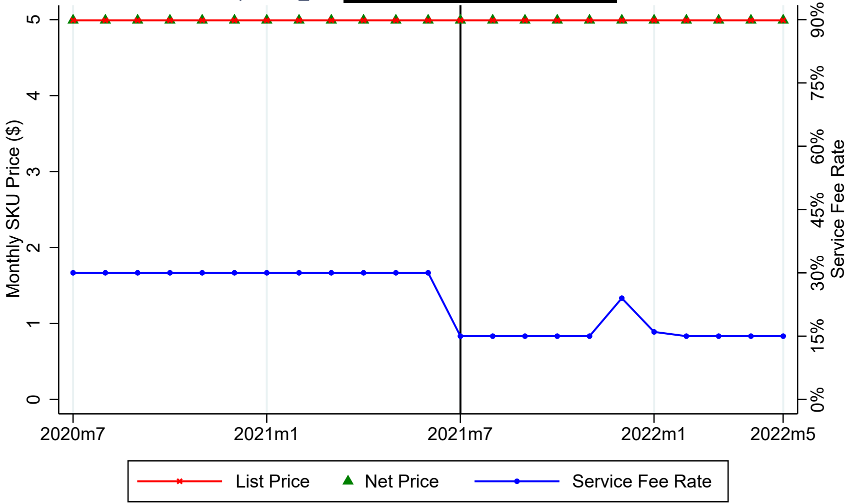
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 81.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 82.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category);
99% (for the corresponding app developer).

product_id = [redacted]

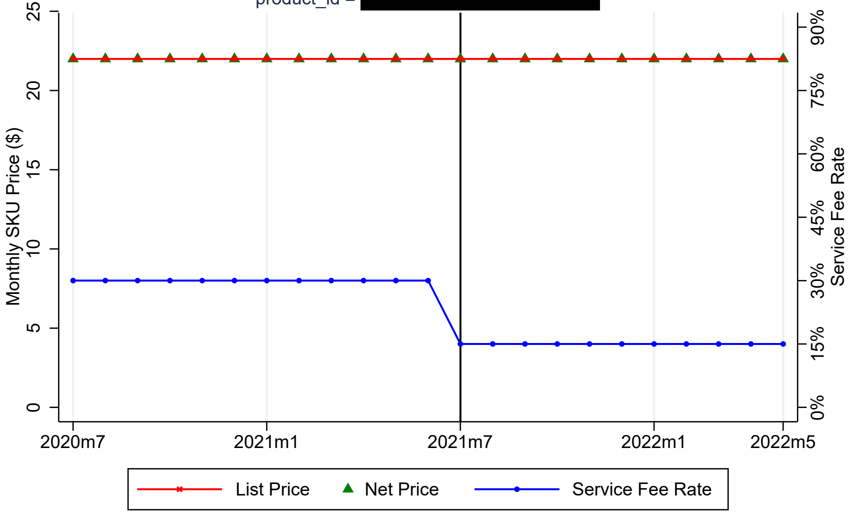


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 83.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]

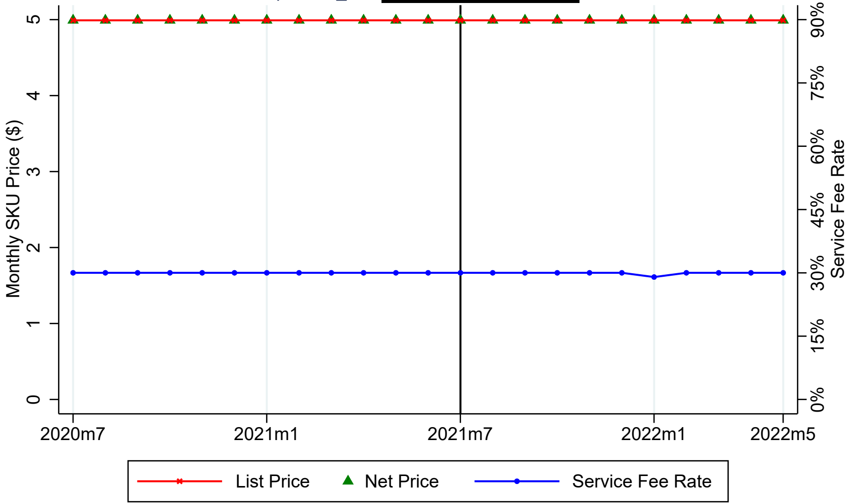
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 84.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 85.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

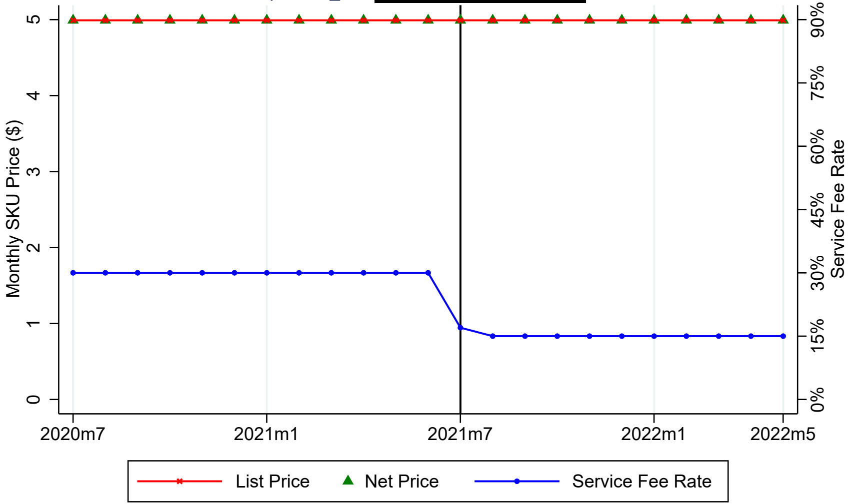


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 89.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 90% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 91.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 93% (for the corresponding app developer).

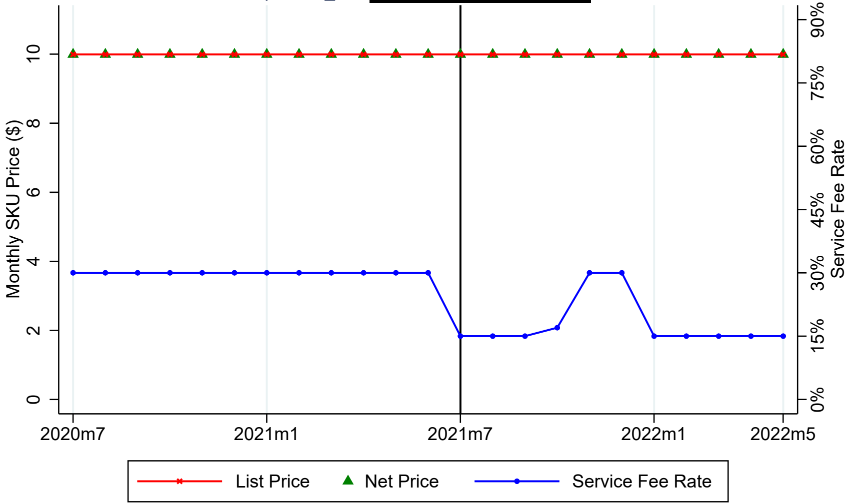
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 92.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



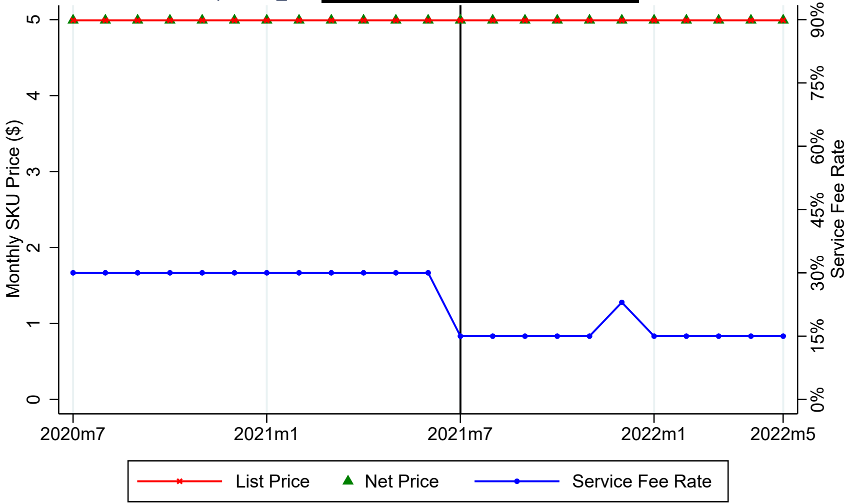
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 93.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 94.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 98.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 85% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 99.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category);
97% (for the corresponding app developer).

product_id = [redacted]

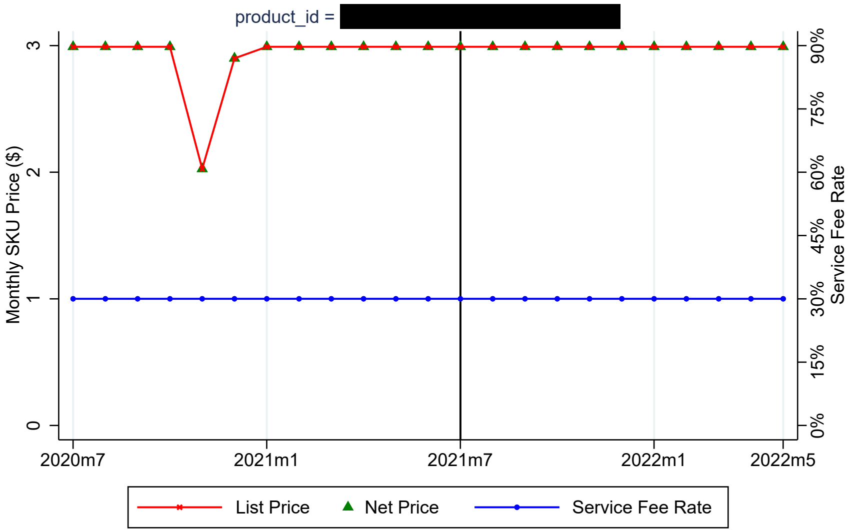
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 1.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 60% (for the corresponding app developer).

product_id = [redacted]

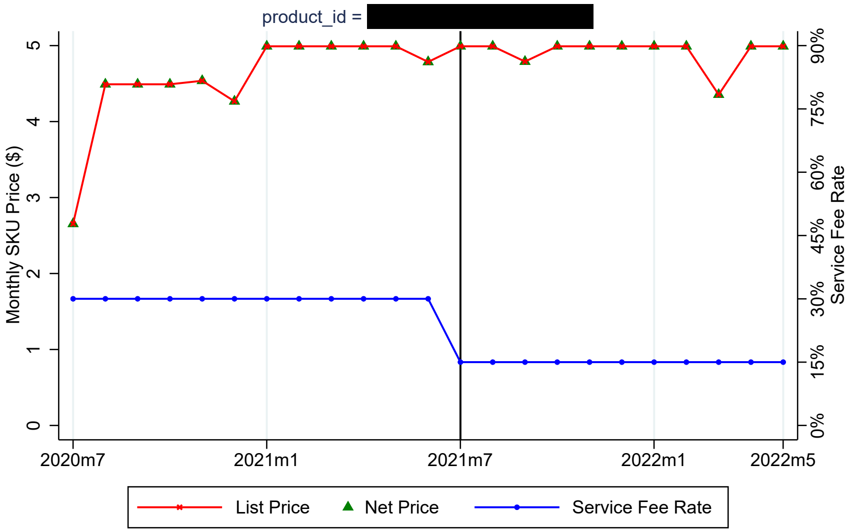
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 2.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 4.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 49% (for the corresponding app developer).

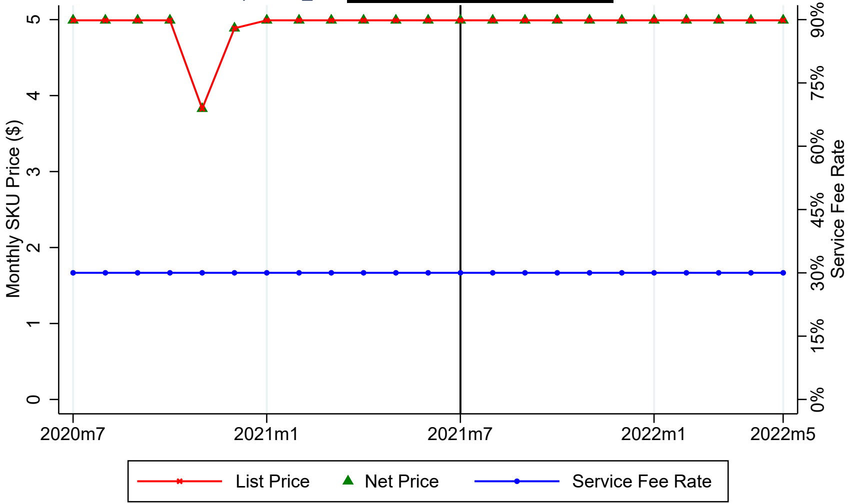


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 17.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 79% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 19.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 69% (for the corresponding app category); 55% (for the corresponding app developer).

product_id = [redacted]

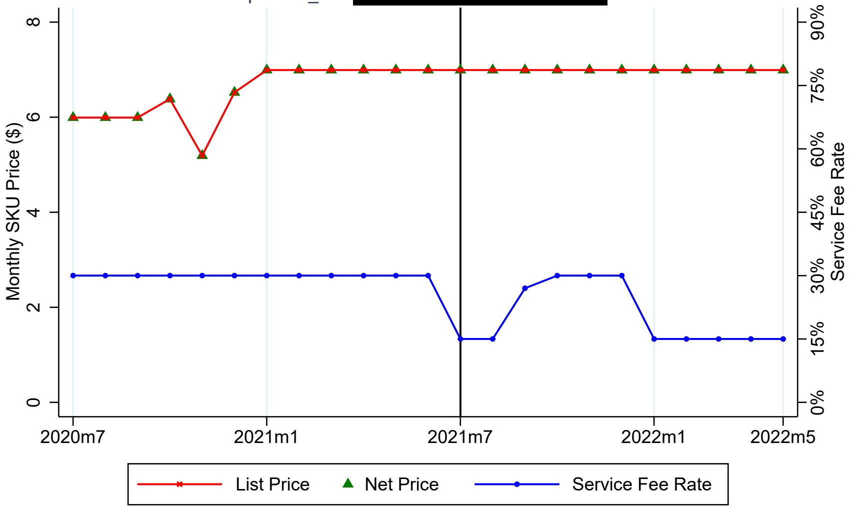


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 20.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 24.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 93% (for the corresponding app developer).

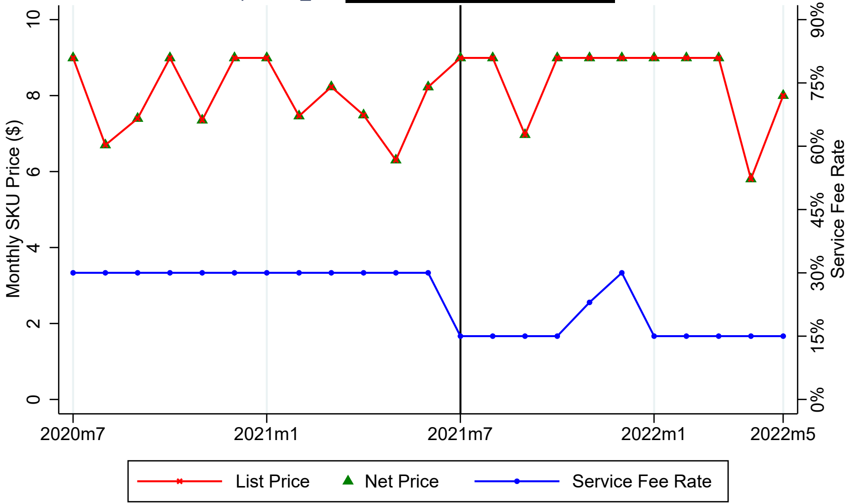
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 26.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 96% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 27.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 30.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 92% (for the corresponding app developer).

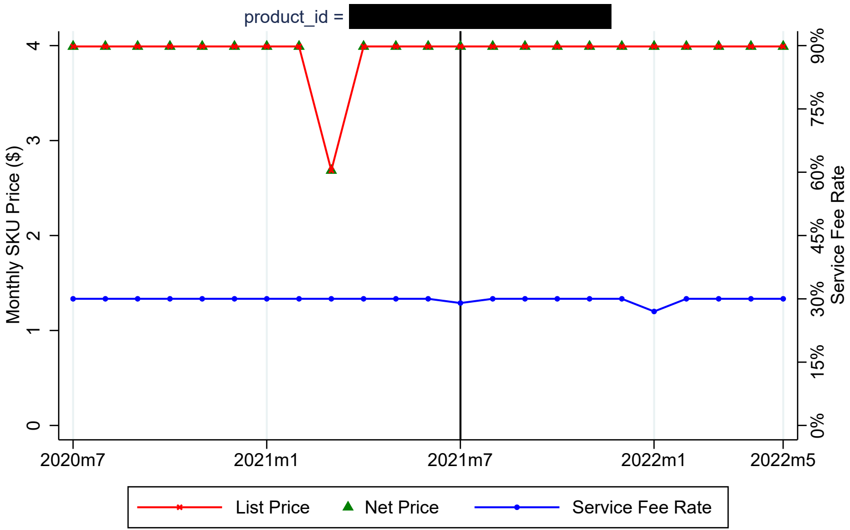
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 32.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 89% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 36.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category);
99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 41.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 95% (for the corresponding app category); 88% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 43.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 26% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 48.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 53.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 49% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 54.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category);
89% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 58.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 97% (for the corresponding app developer).

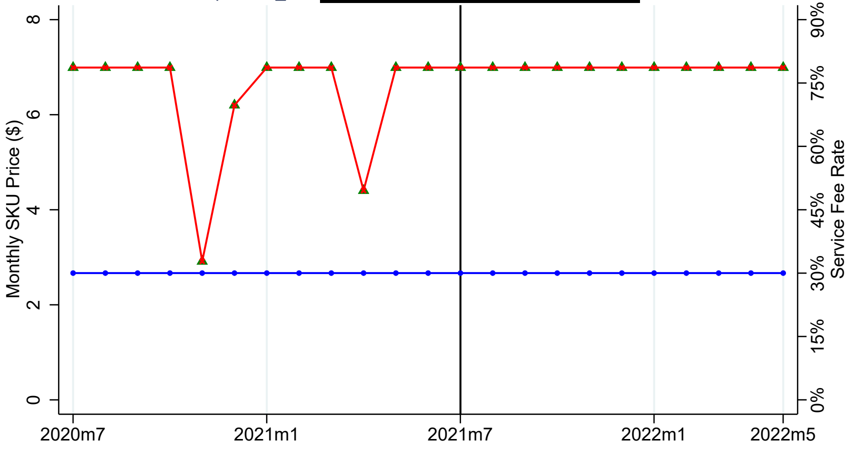
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 63.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category);
97% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 65.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 66.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 71.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 49% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 74.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

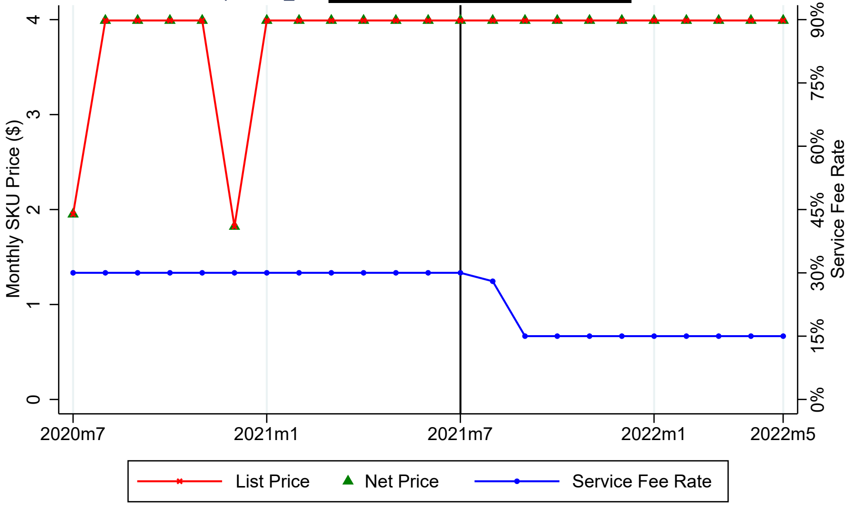
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 77.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 98% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 80.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 86.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 87.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 95% (for the corresponding app developer).

product_id = [redacted]

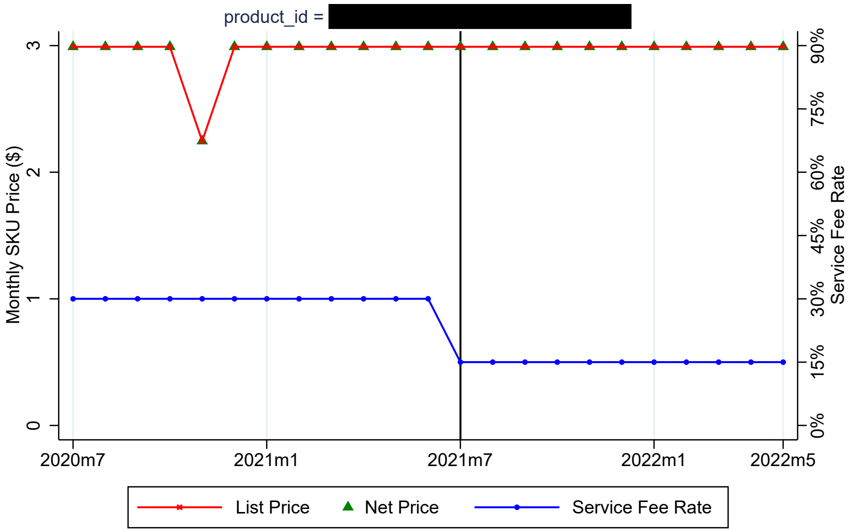
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 88.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category);
80% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 90.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 68% (for the corresponding app category); 92% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 96.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 87% (for the corresponding app developer).



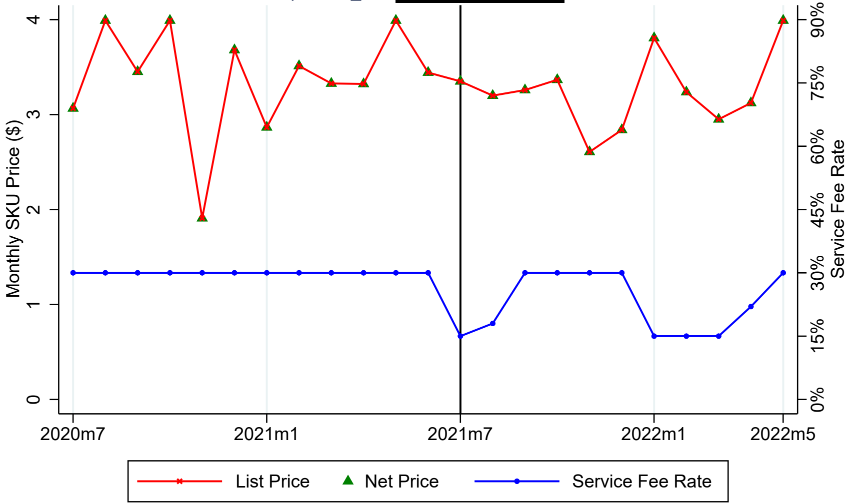
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 97.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 100.
[2] Price change before and after July 2021: increase in the list price, increase in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 94% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 5.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 74% (for the corresponding app developer).

product_id = [redacted]

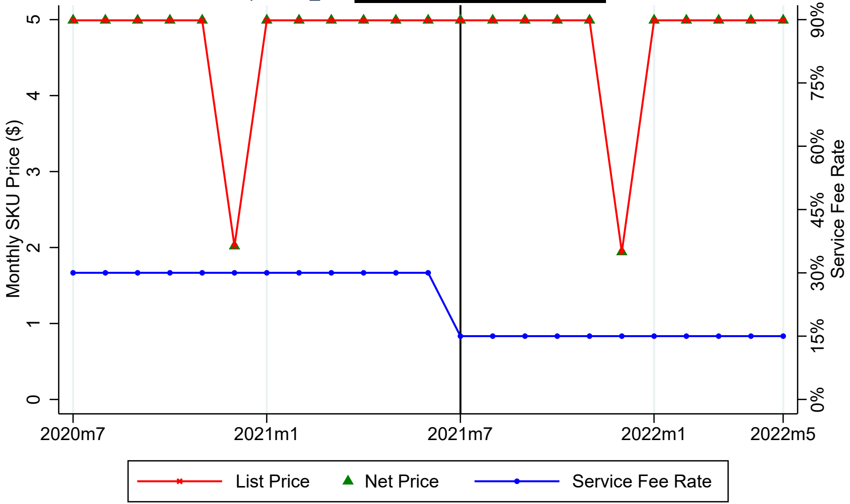


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 14.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 49% (for the corresponding app developer).

product_id = [redacted]

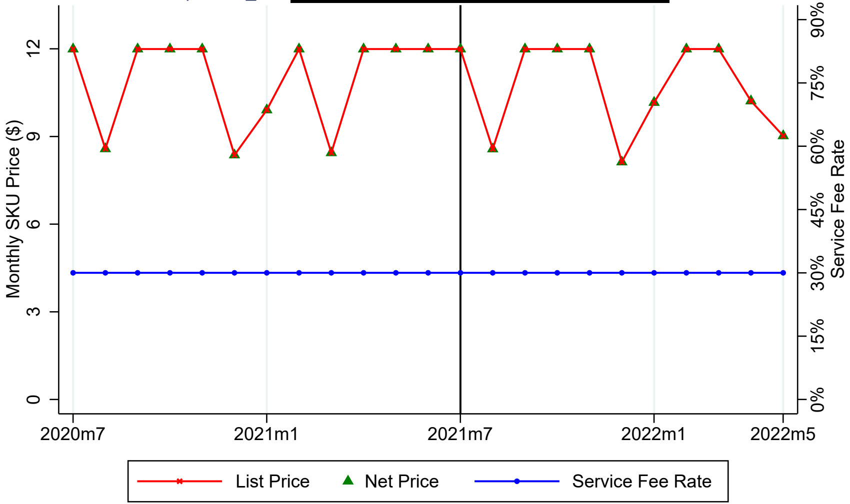
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 15.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category);
89% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 29.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 87% (for the corresponding app developer).

product_id = [redacted]



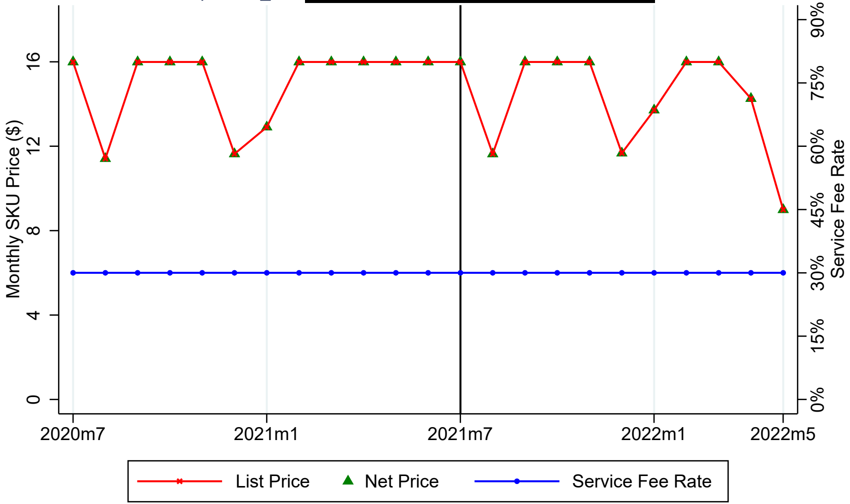
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 31.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 96% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 37.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 91% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 46.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 56.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

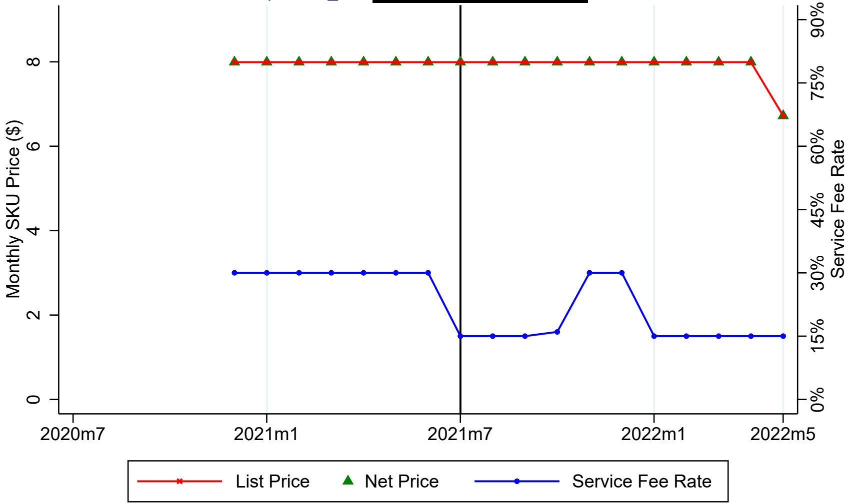
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 61.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 94% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 62.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]



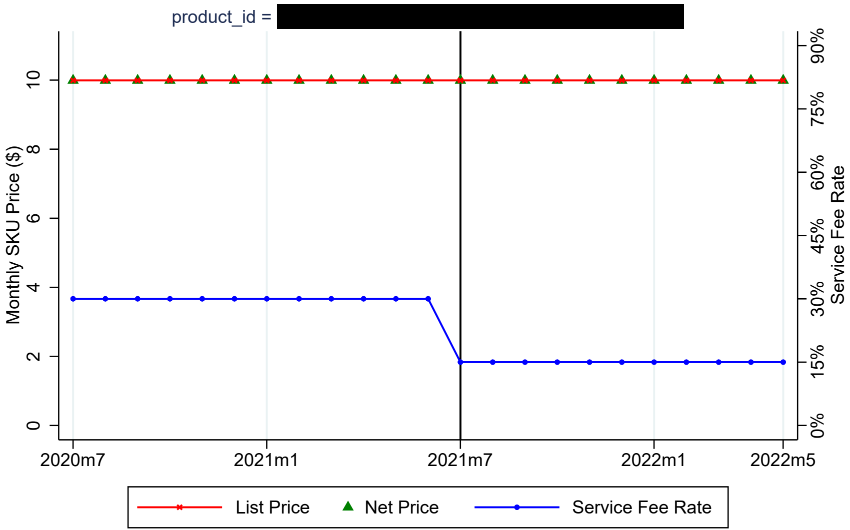
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 69.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category);
71% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 95.
[2] Price change before and after July 2021: decrease in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

Exhibit 36a

Average Monthly Product Price and Service Fee Rate for the Top 100 IAPs

With A Flat Service Fee Rate Reduction of 15 Percentage Points After July 2021



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 2.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 100% (for the corresponding app developer).

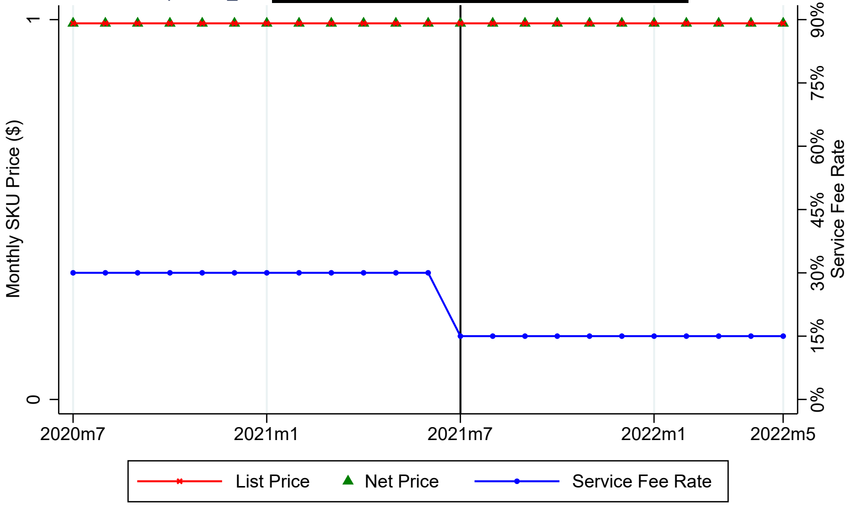
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 3.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 4.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category);
99% (for the corresponding app developer).

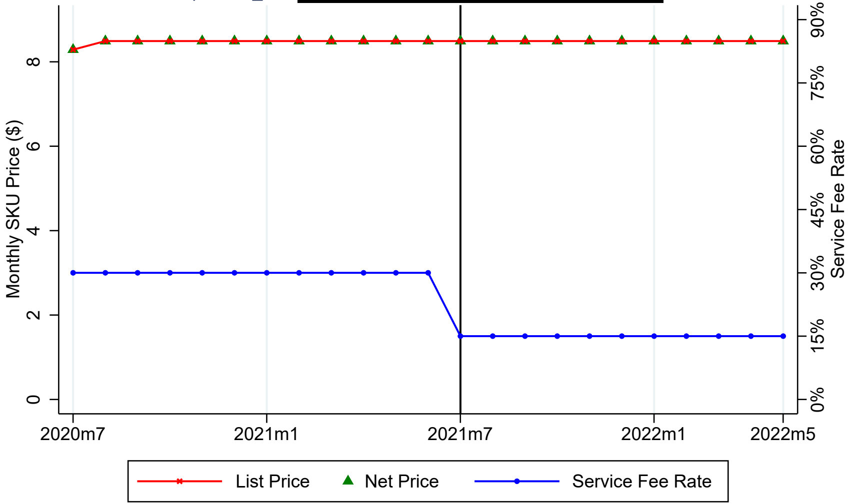
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 5.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 93% (for the corresponding app developer).

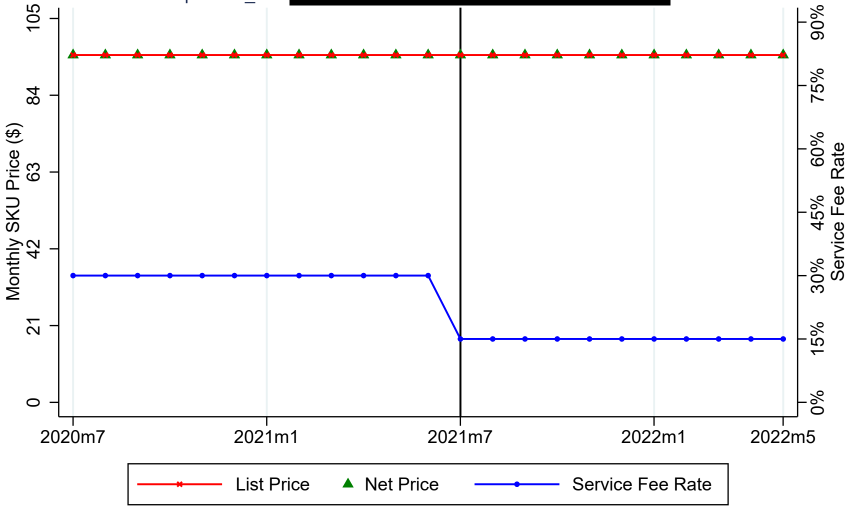
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 6.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 83% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 7.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 9.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 10.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 11.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 12.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 94% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 13.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

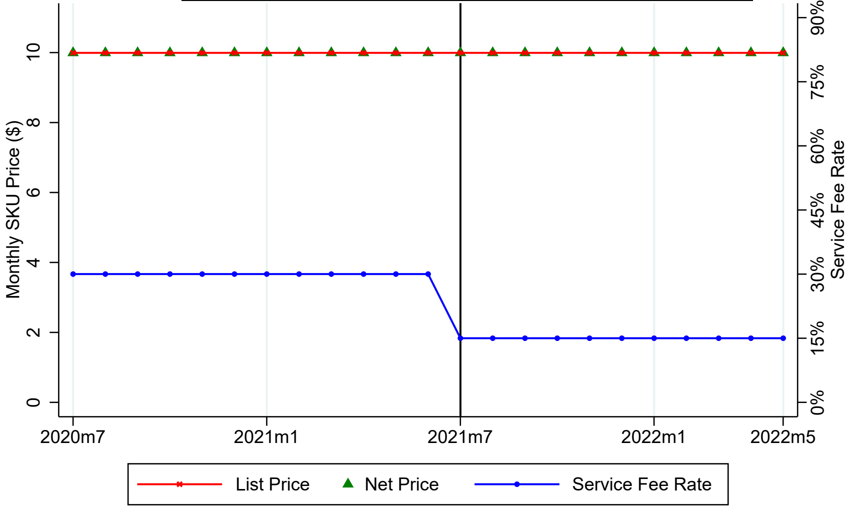
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 14.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

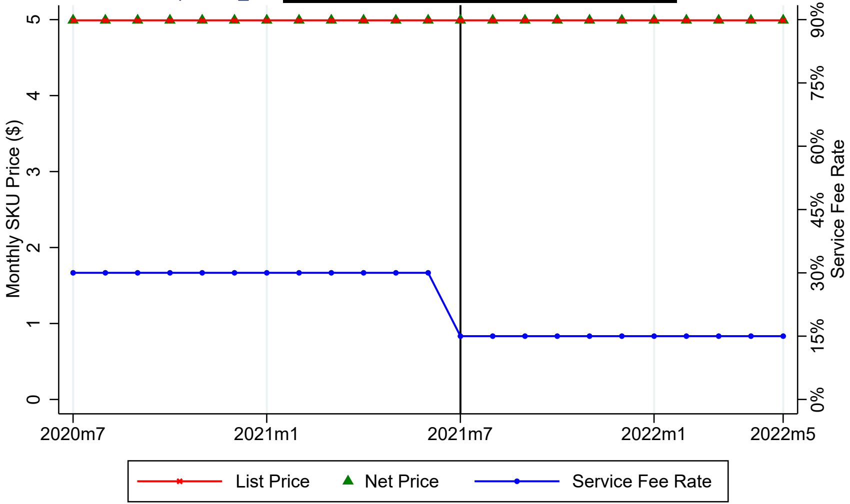
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 15.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 16.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 17.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 18.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 95% (for the corresponding app developer).

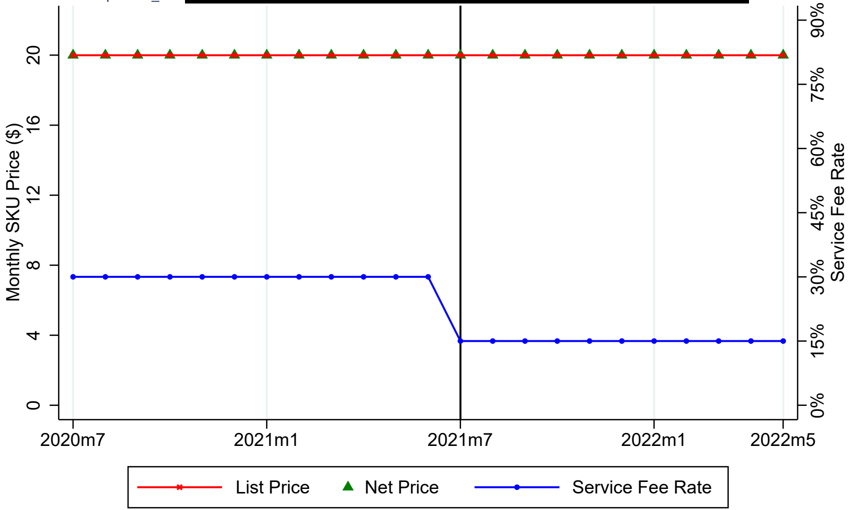
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 19.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

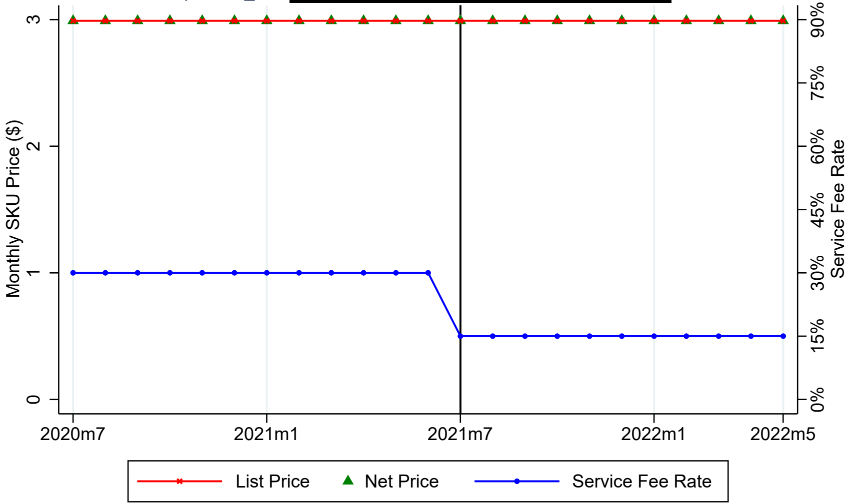
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 20.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 21.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 22.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 23.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).

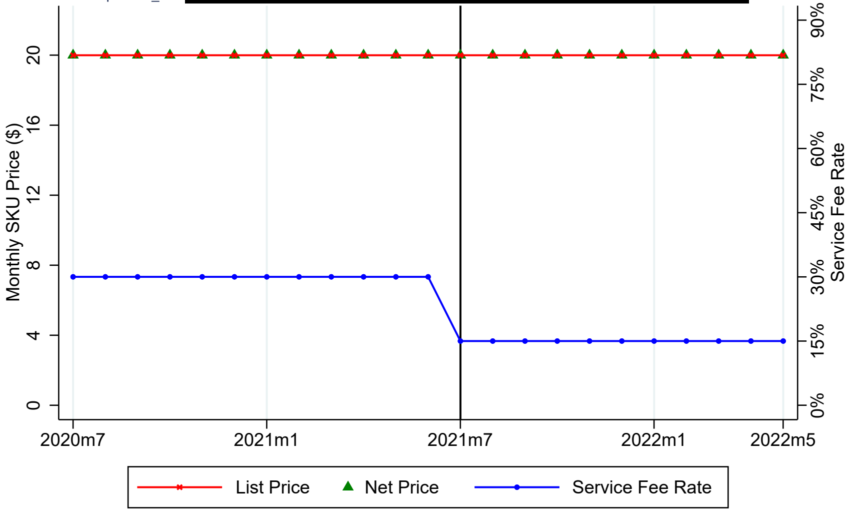
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 24.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 25.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category);
100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 26.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

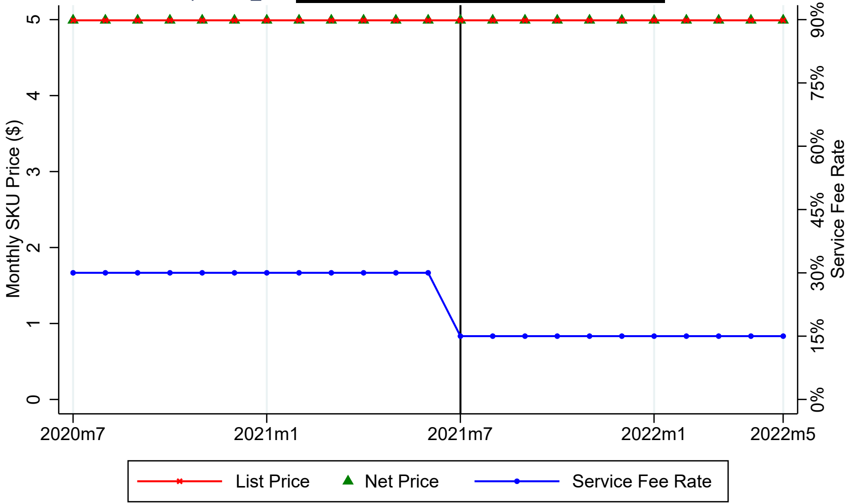
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 27.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 28.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 29.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category);
100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 30.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 31.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 32.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 99% (for the corresponding app developer).

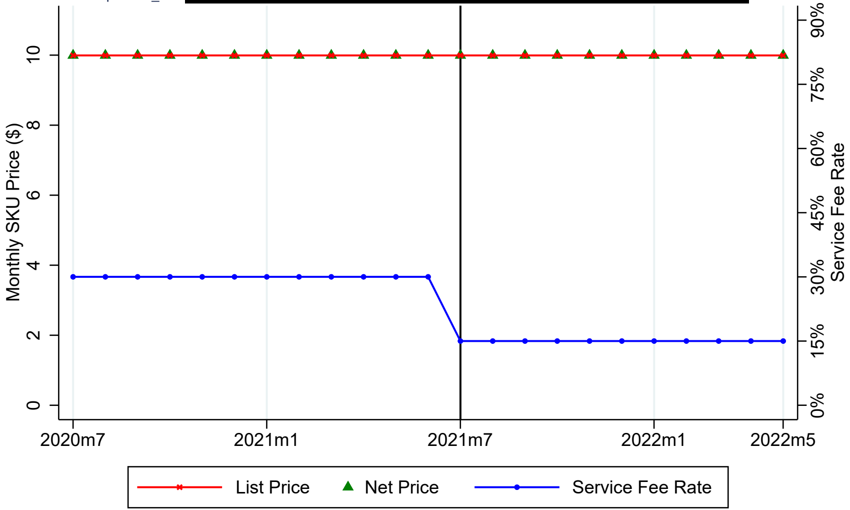
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 33.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 34.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 35.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category);
100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 36.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 37.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category);
100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 38.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 39.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

[redacted]

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 42.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 43.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 87% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 44.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 45.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 46.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 48.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).

[redacted]

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 50.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category);
99% (for the corresponding app developer).

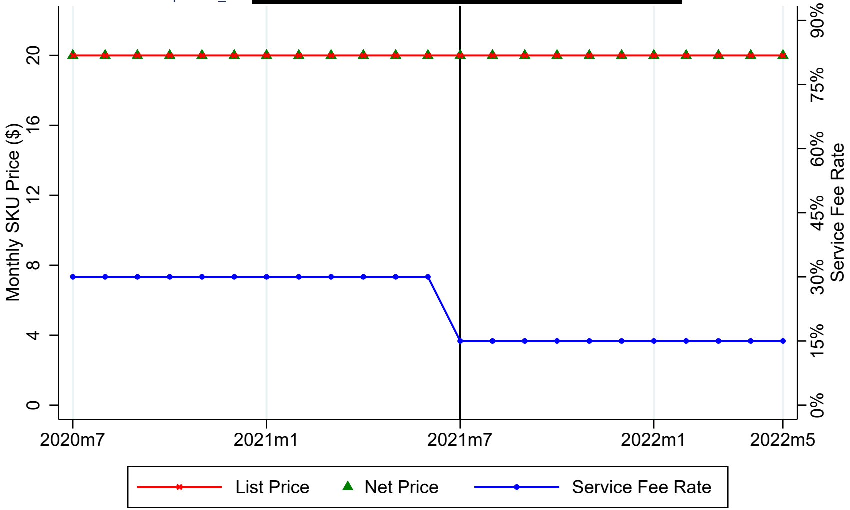
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 51.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

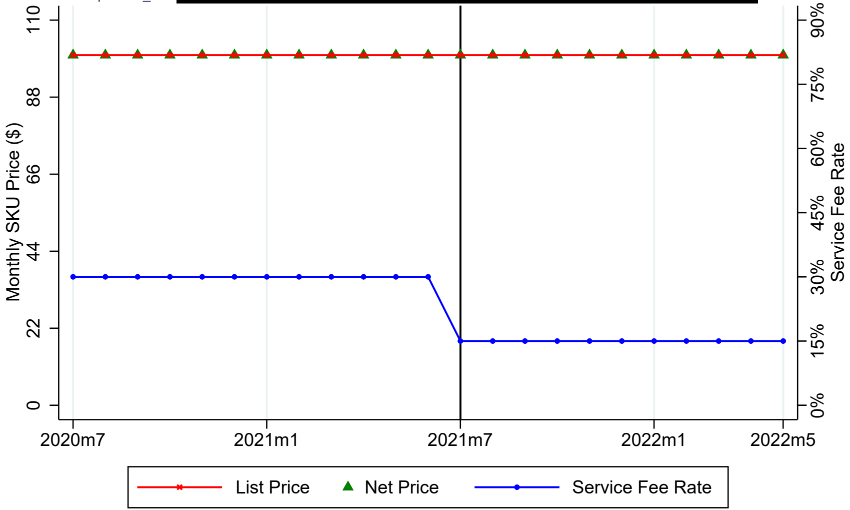
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 52.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



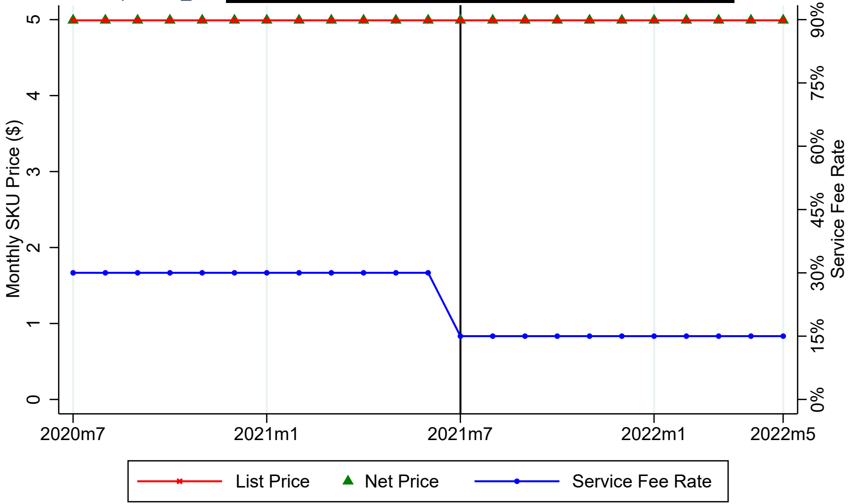
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 55.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 95% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

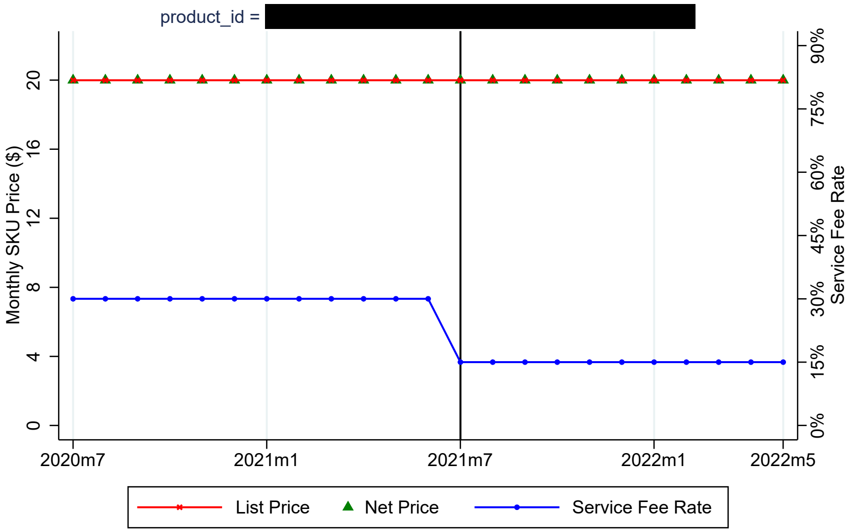


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 56.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 57.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category);
100% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 60.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 61.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 39% (for the corresponding app category); 86% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 63.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

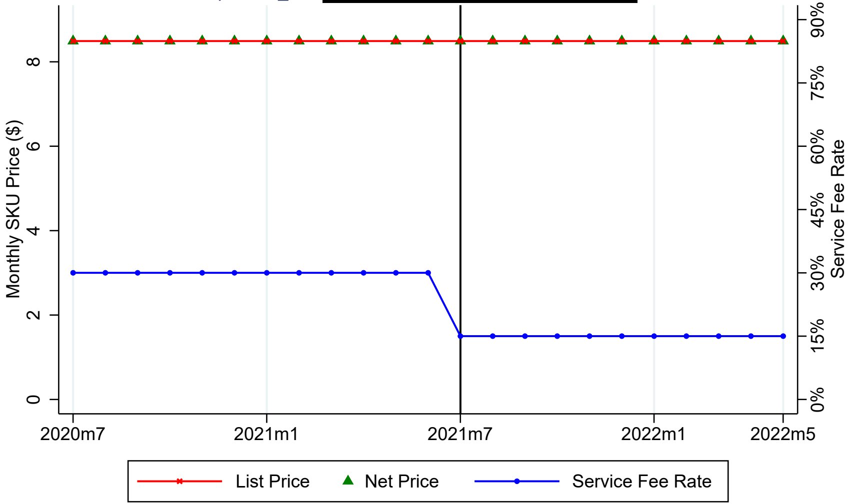
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 65.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

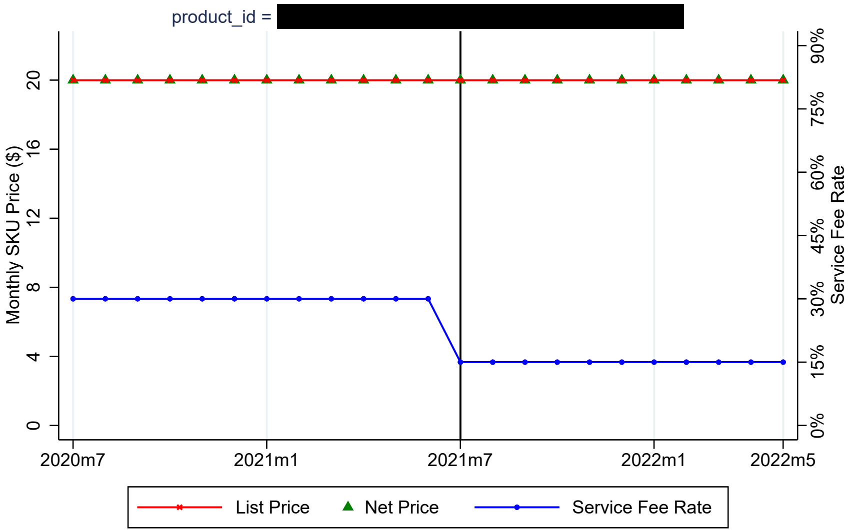
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 66.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

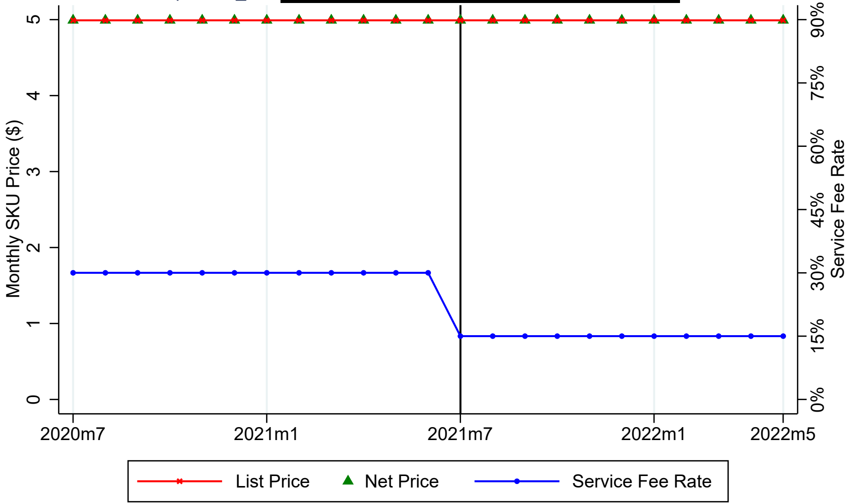


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 67.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 98% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 68.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 69.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 100% (for the corresponding app developer).

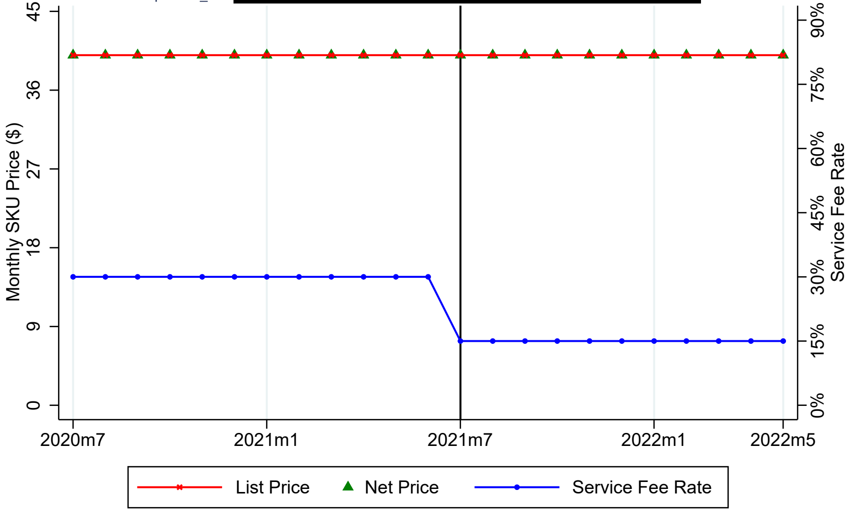
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 70.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 71.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).

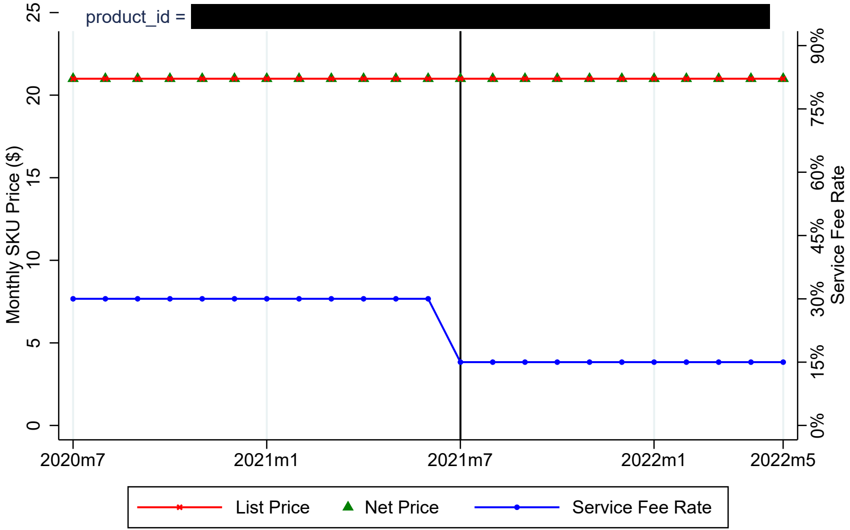
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 72.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

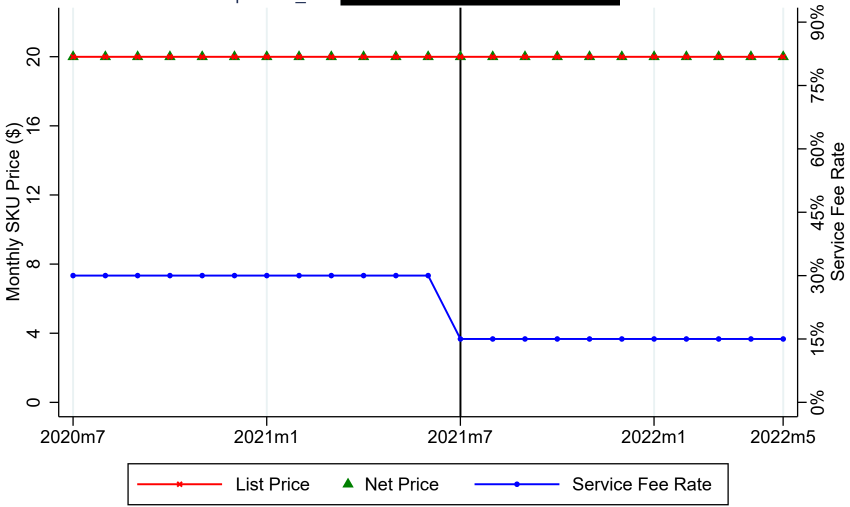
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 75.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 87% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 76.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

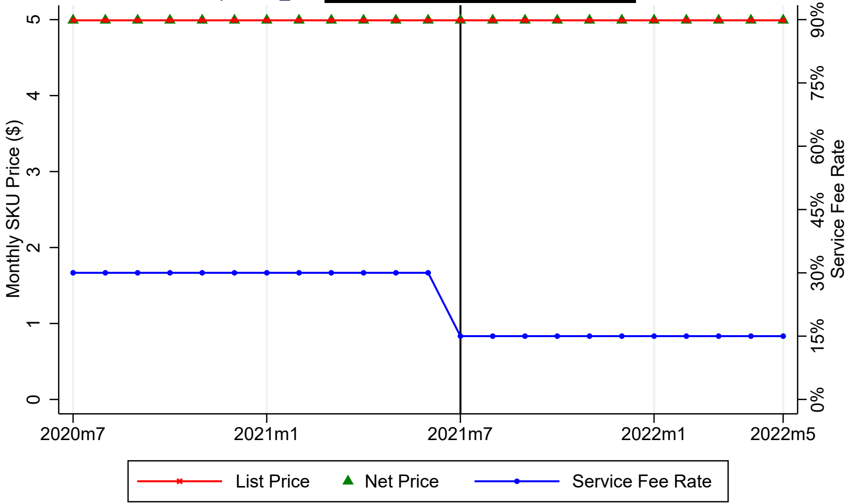


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 77.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 78.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 80.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 81.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 82.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category);
100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 84.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 85.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category);
99% (for the corresponding app developer).

product_id = [redacted]

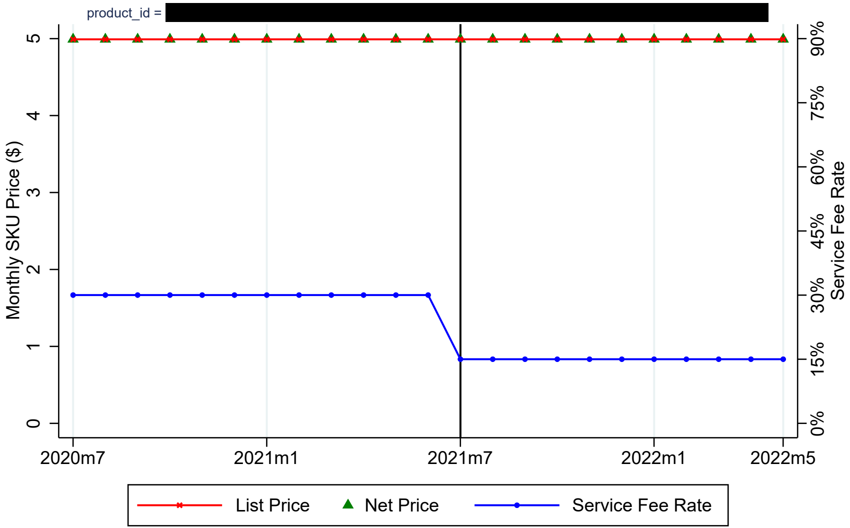
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 86.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 87.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

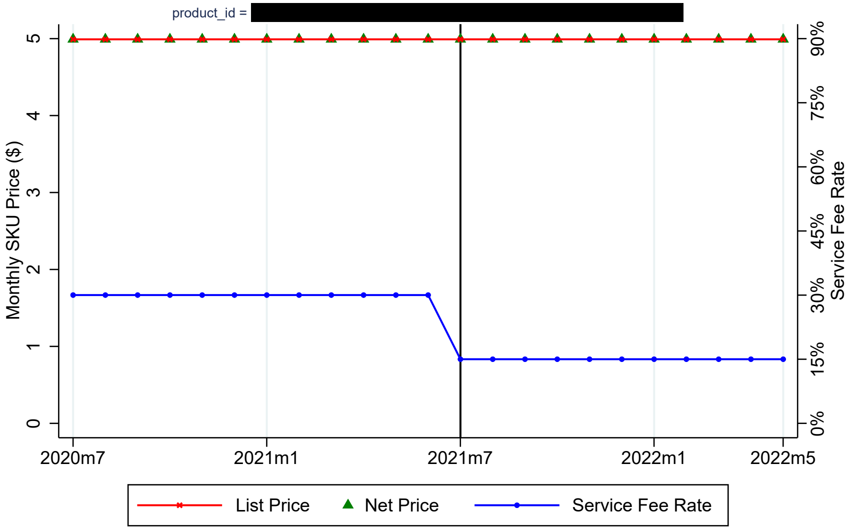
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 88.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 89.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 90.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 97% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 91.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

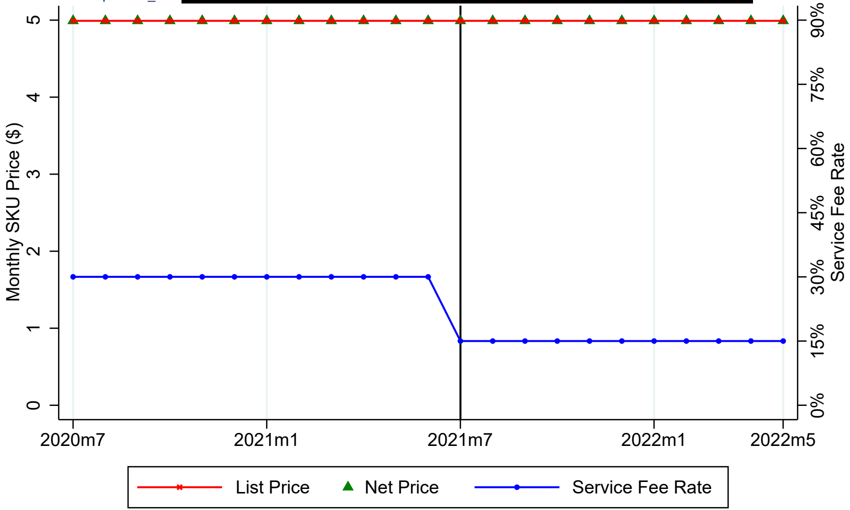
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 92.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 94.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 95.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

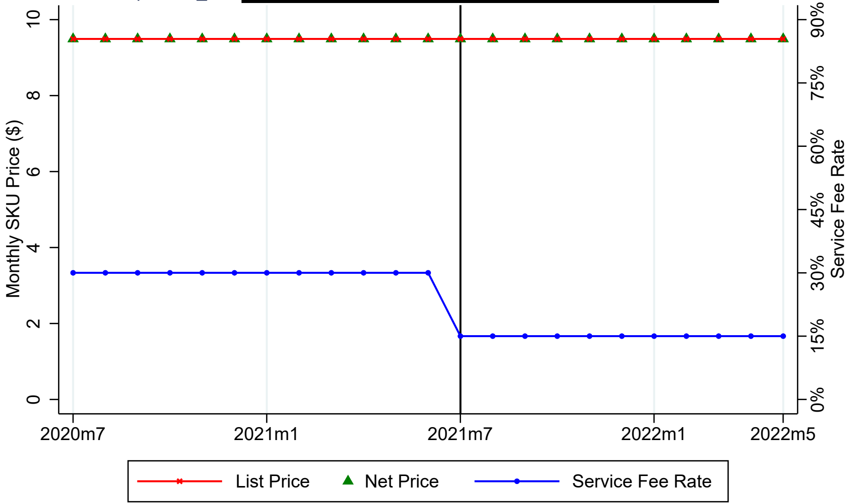


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 96.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 97.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 98.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 82% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 99.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 100.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 1.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]

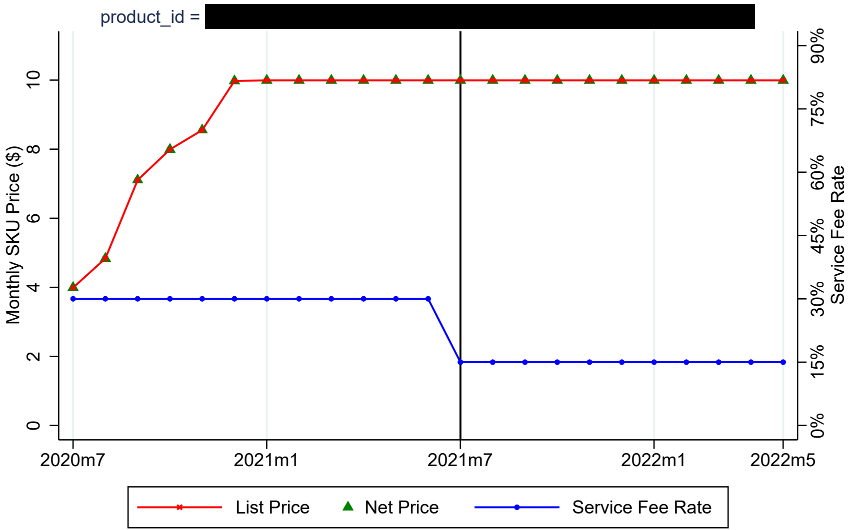
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 8.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 83% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 40.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 68% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 53.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category);
100% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 54.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 58.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category);
95% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 59.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category);
100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 62.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 68% (for the corresponding app category); 92% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 64.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category);
100% (for the corresponding app developer).

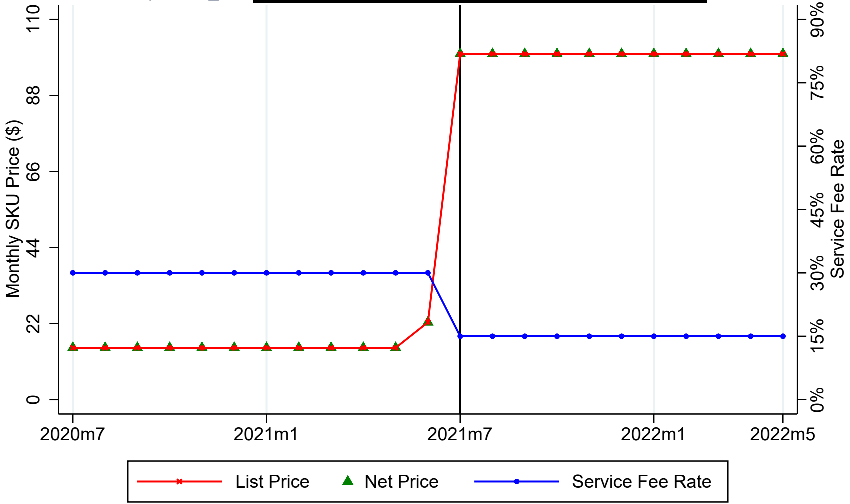
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 73.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 74.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 79.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 86% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 83.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 93.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 83% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 47.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 95% (for the corresponding app category);
94% (for the corresponding app developer).

Exhibit 36b

Average Monthly Product Price and Service Fee Rate for the Top 100 IAPs With A Service Fee Rate Reduction of At Least 10 Percentage Points in July 2021

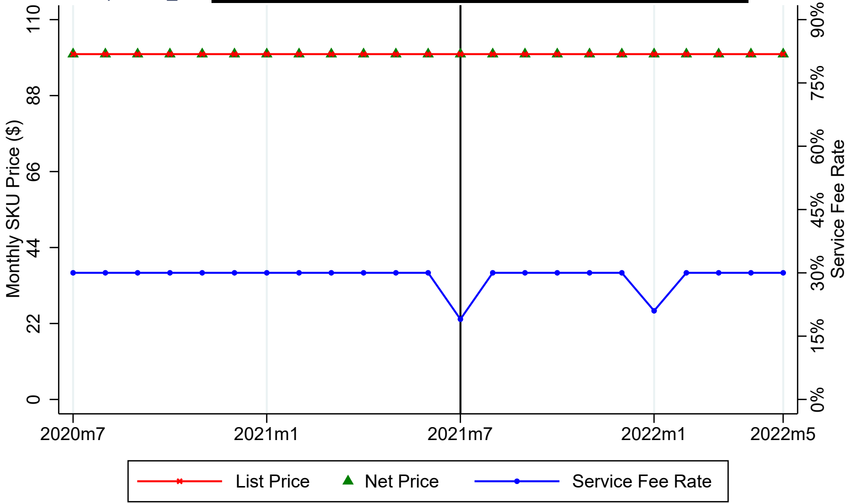
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 1.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

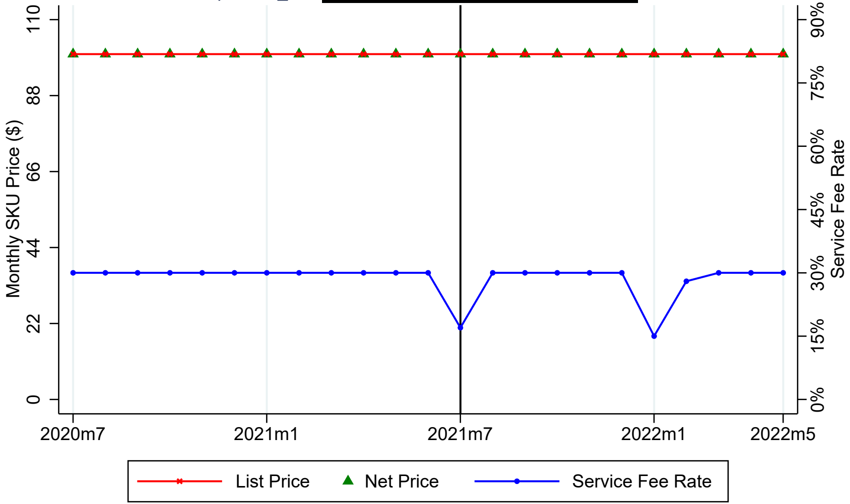
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 2.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 80% (for the corresponding app developer).

product_id = [redacted]

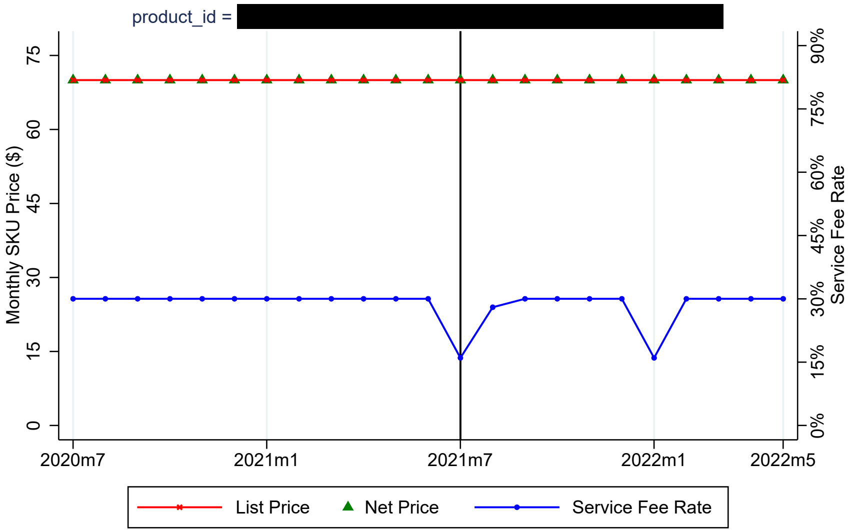


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 3.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category);
80% (for the corresponding app developer).

product_id = [redacted]

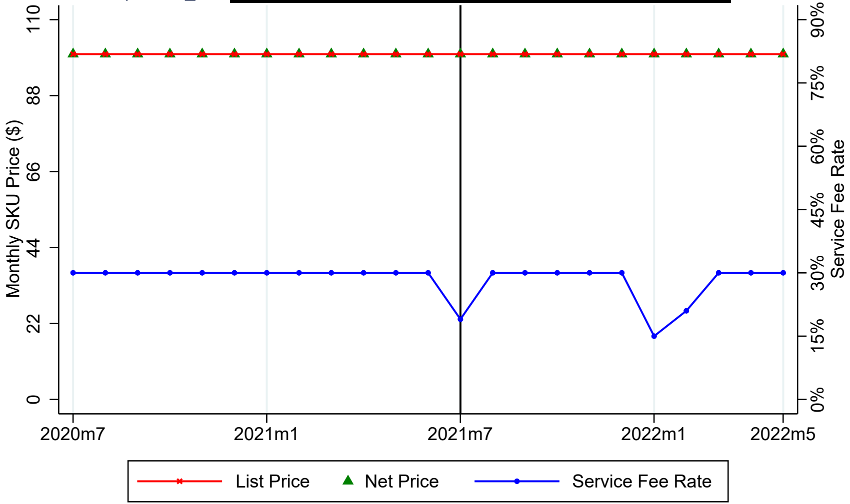


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 4.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 5.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 6.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

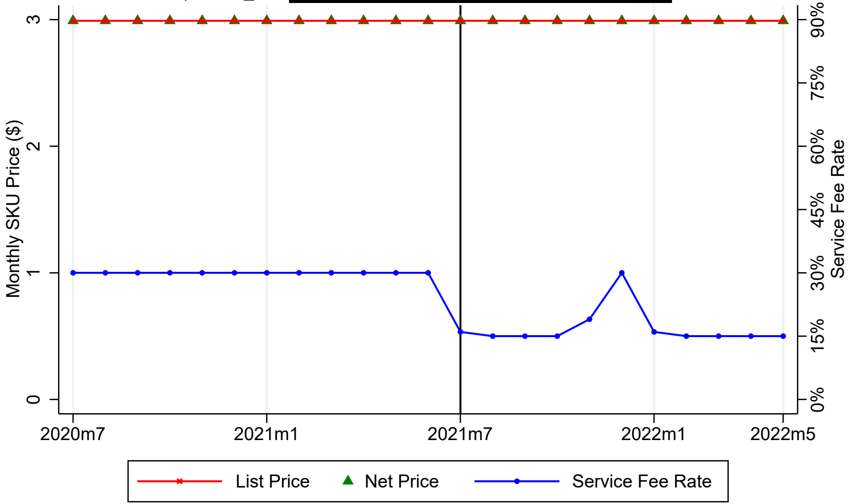
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 7.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

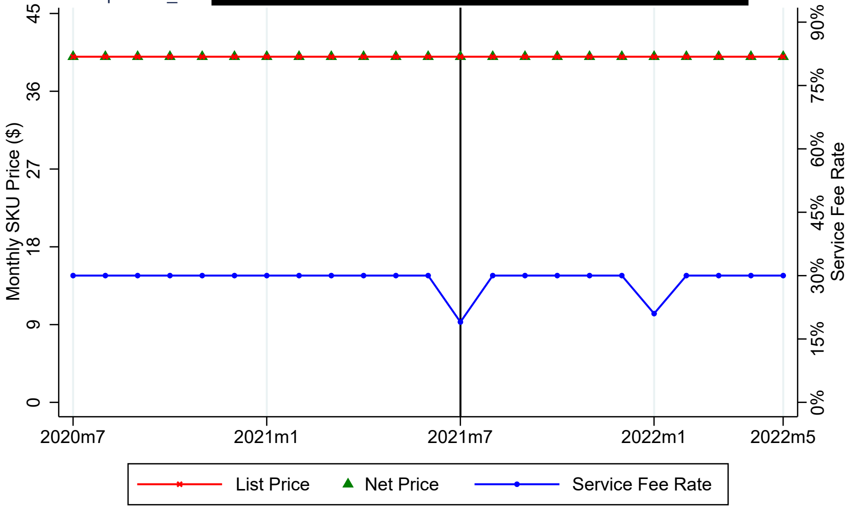
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 8.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



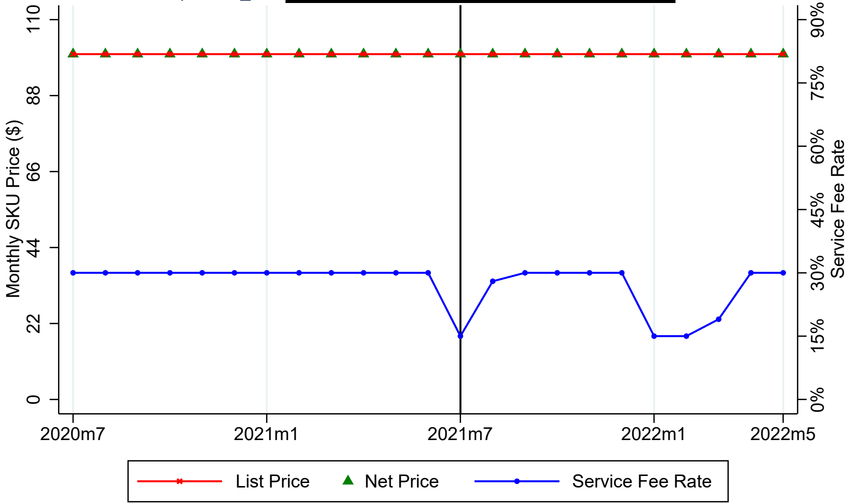
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 9.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 10.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 80% (for the corresponding app developer).

product_id = [redacted]

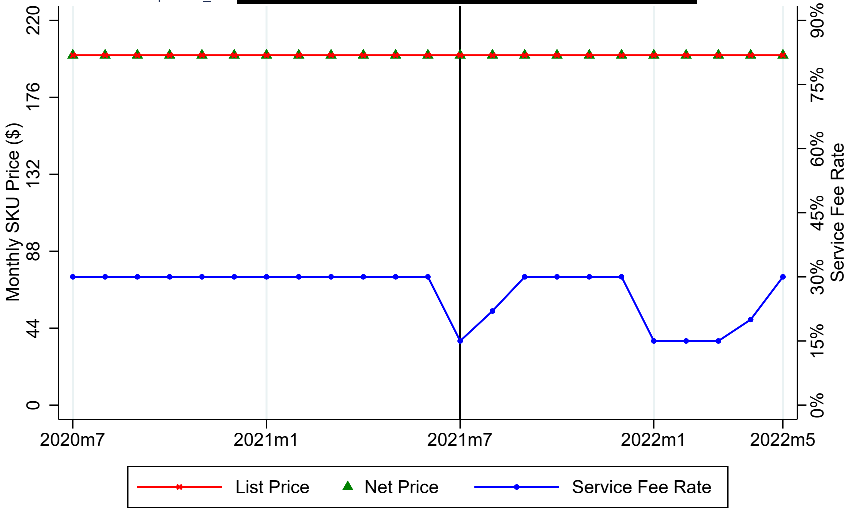


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 11.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

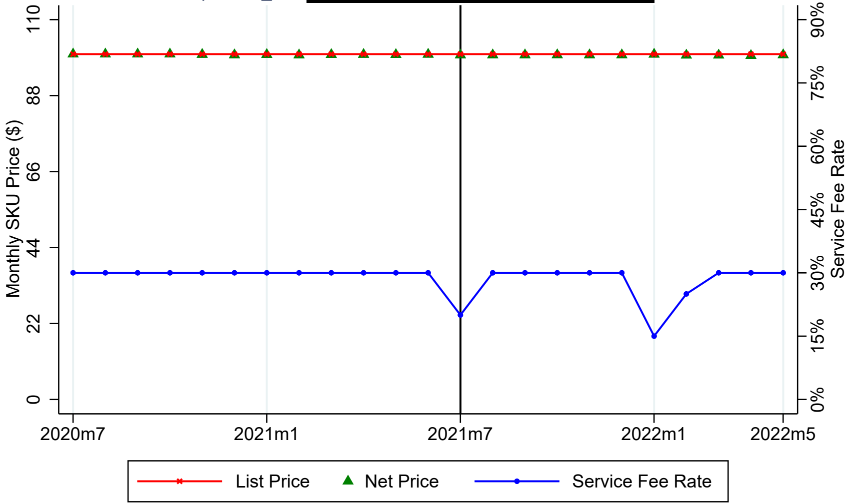
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 12.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 13.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 14.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 15.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 99% (for the corresponding app developer).

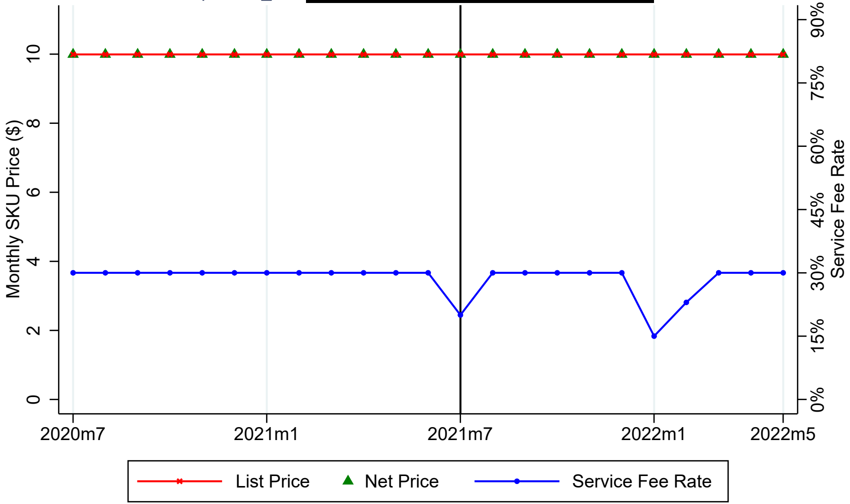
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 16.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

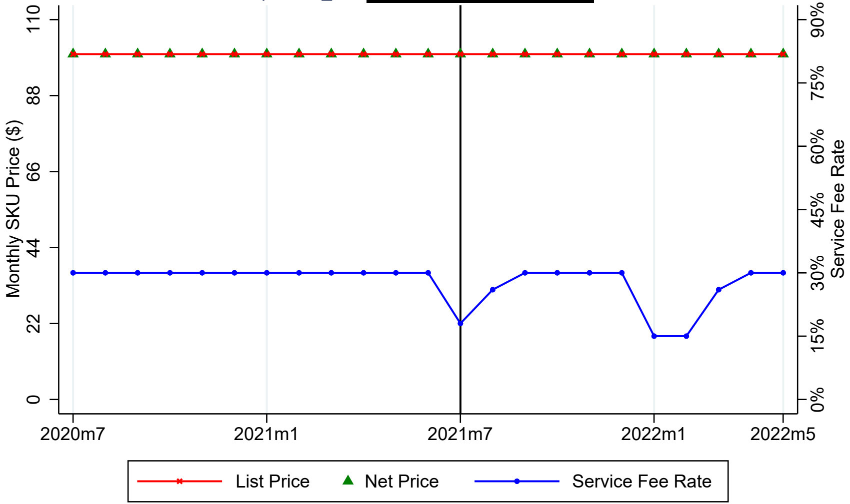
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 17.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 18.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 19.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category);
100% (for the corresponding app developer).

product_id = [redacted]

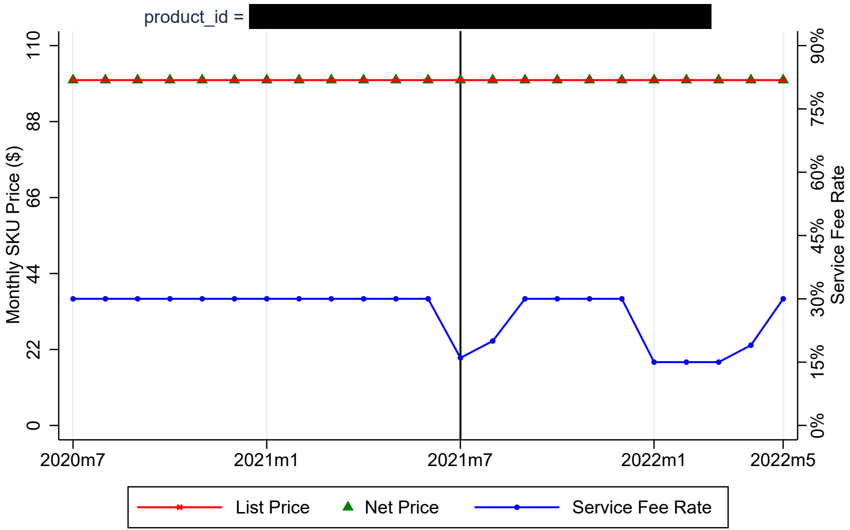
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 20.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 21.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

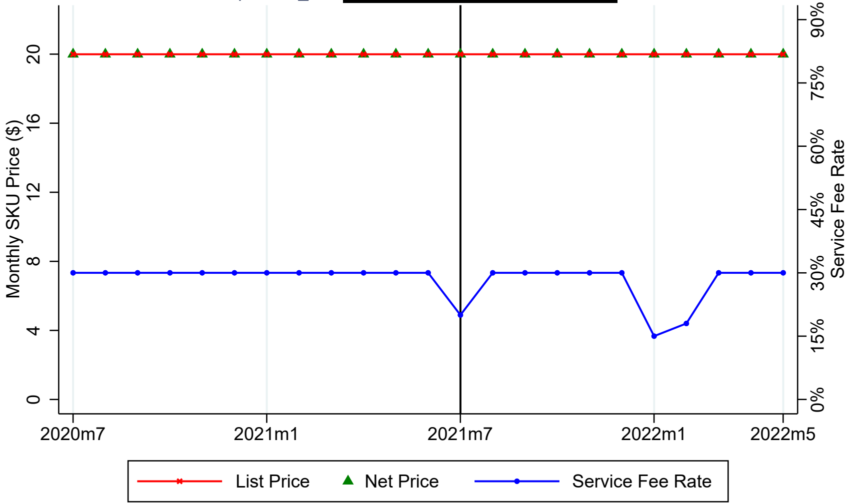
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 22.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).



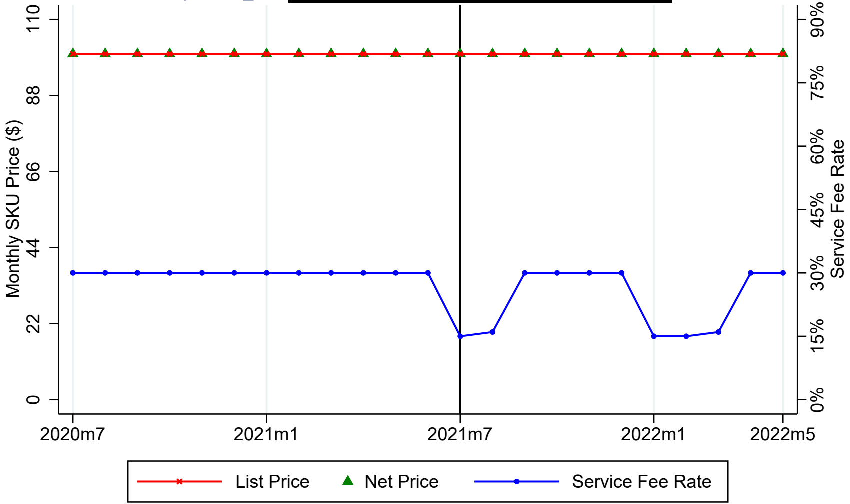
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 23.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



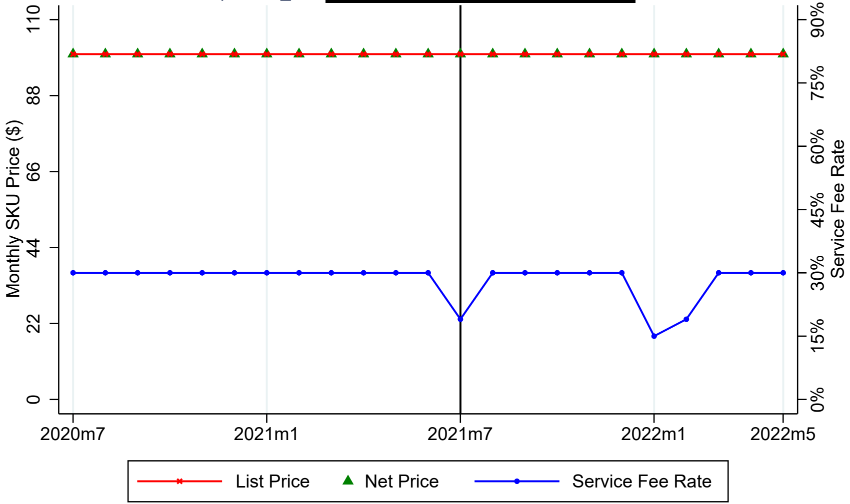
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 24.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category);
99% (for the corresponding app developer).

product_id = [redacted]



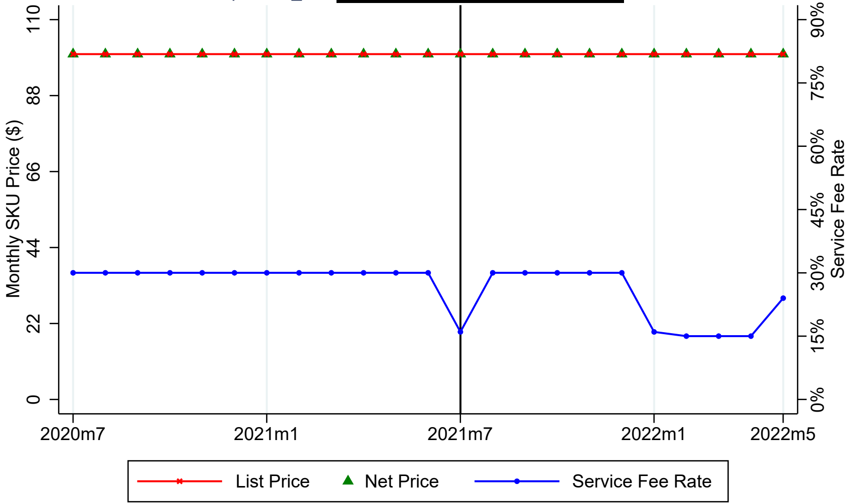
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 25.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 26.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 99% (for the corresponding app developer).

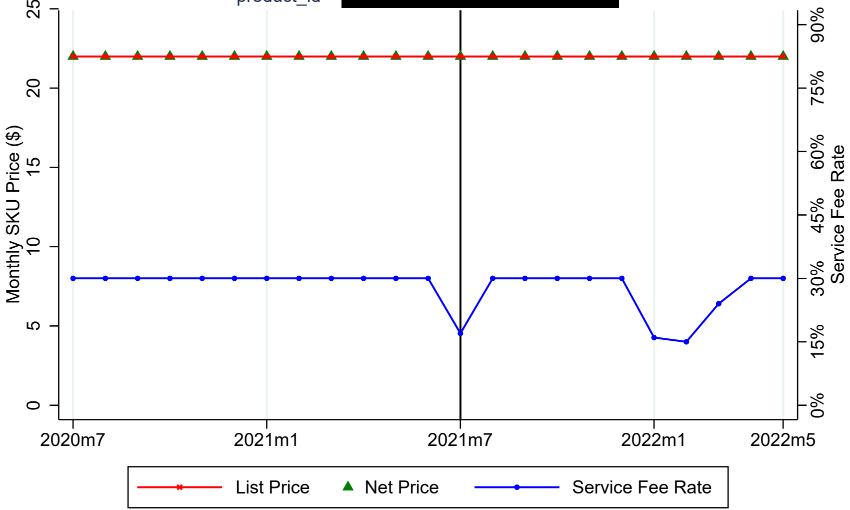
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 28.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category);
100% (for the corresponding app developer).

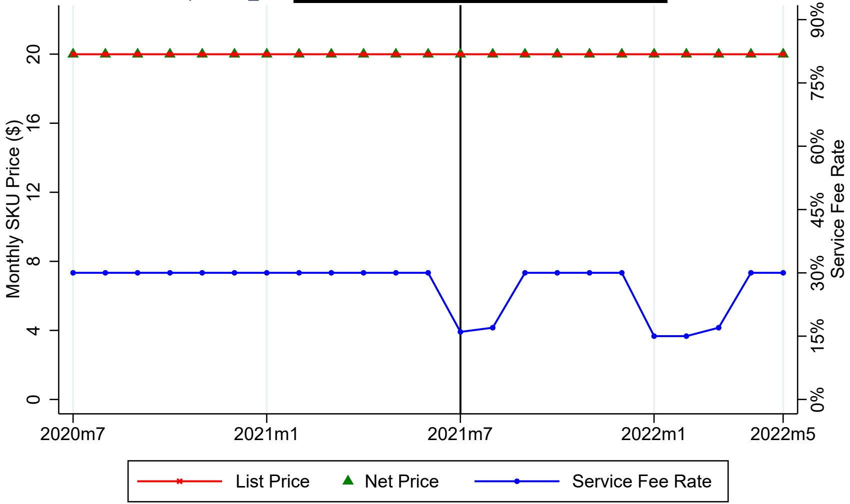
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 29.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



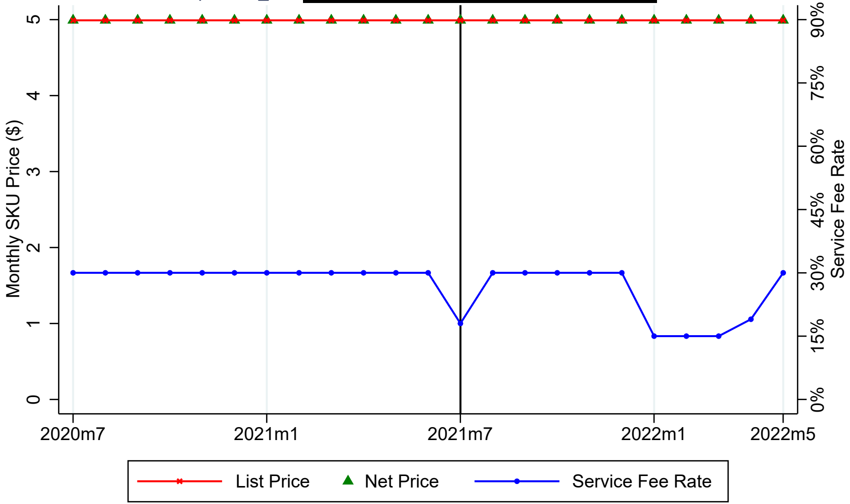
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 30.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]



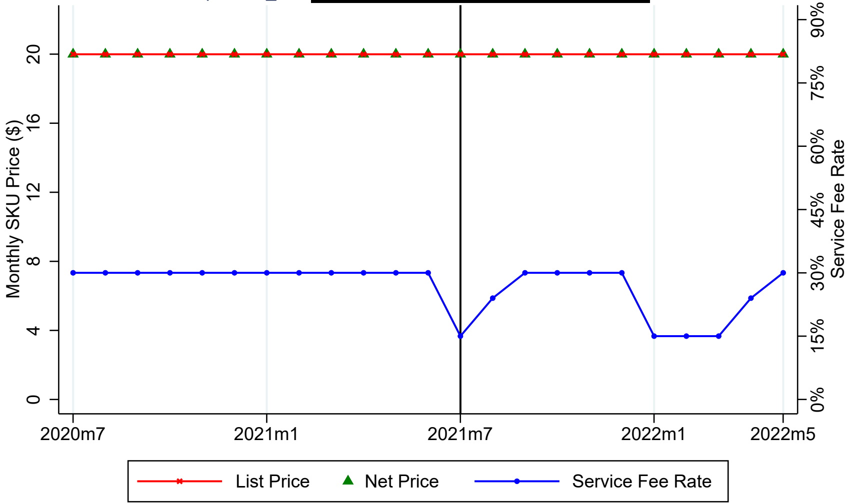
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 31.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]



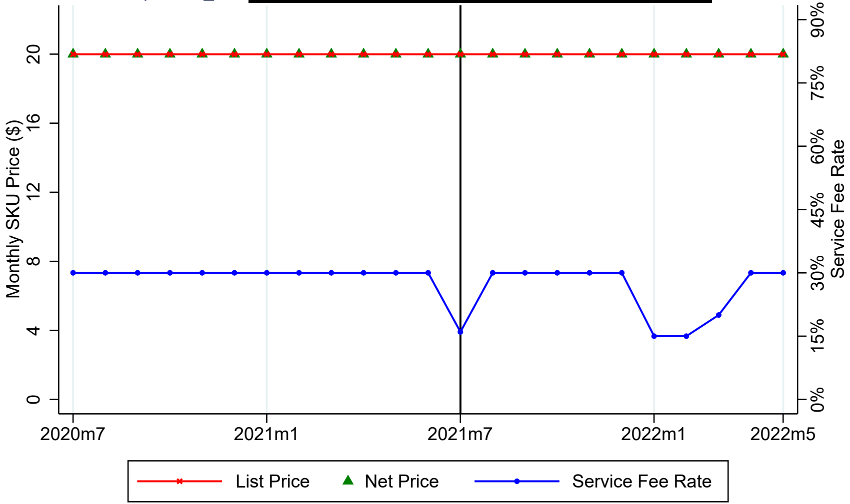
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 32.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

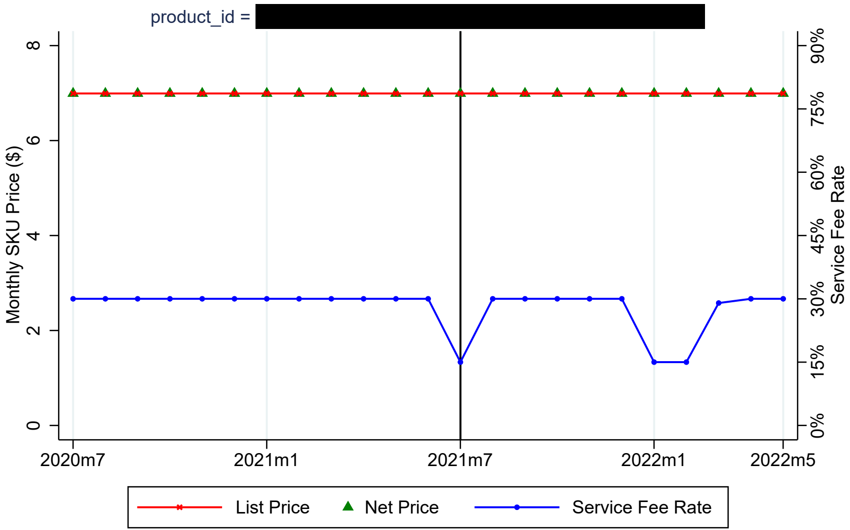


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 33.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 60% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 34.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 35.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 99% (for the corresponding app developer).

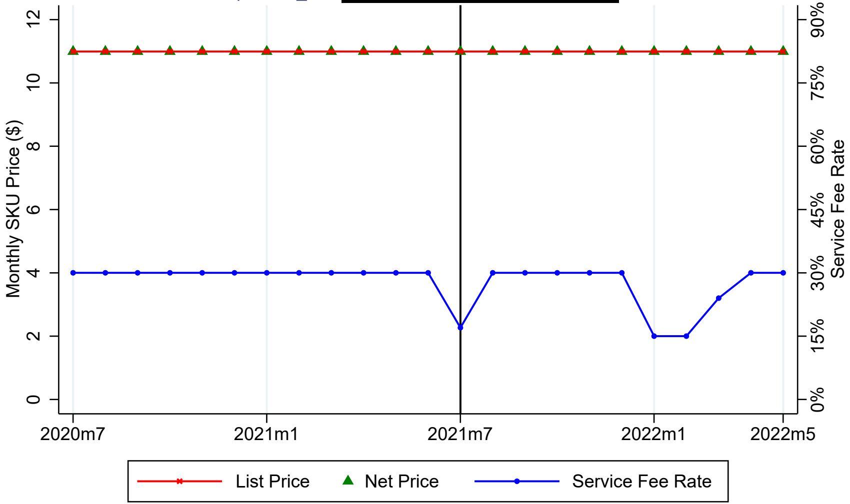
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 36.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 37.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 38.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 97% (for the corresponding app developer).

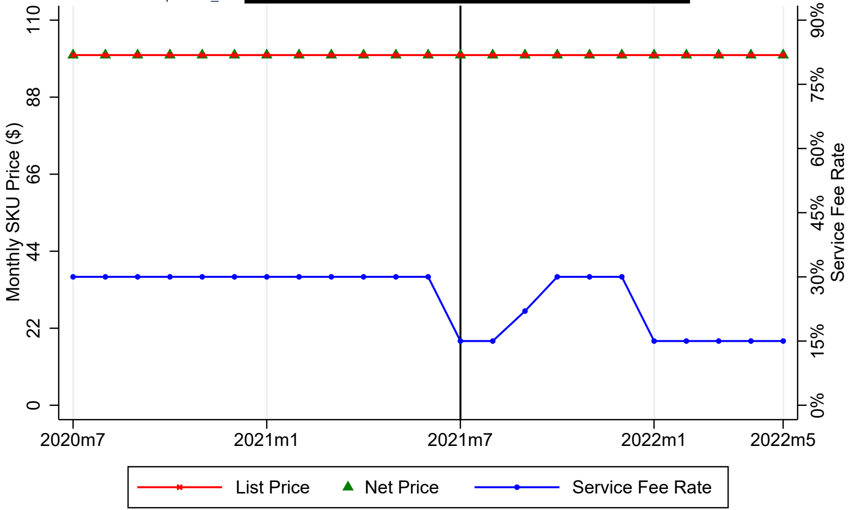
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 39.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

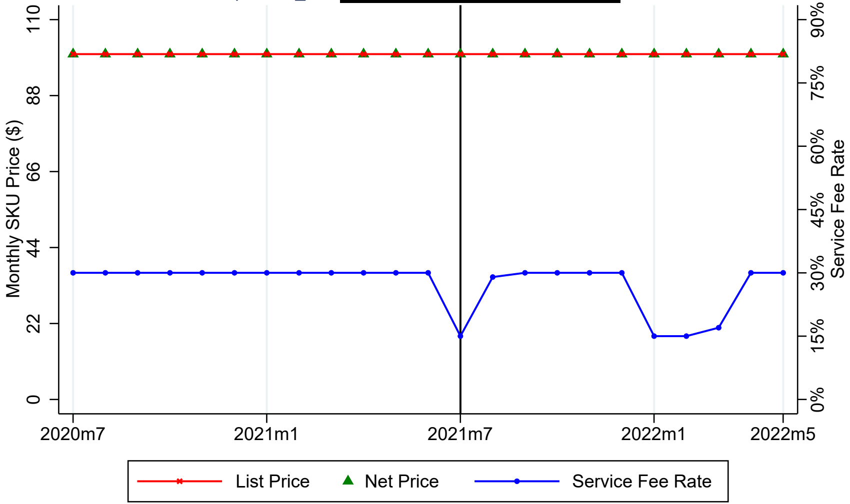
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 40.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 41.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 42.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 82% (for the corresponding app category);
98% (for the corresponding app developer).

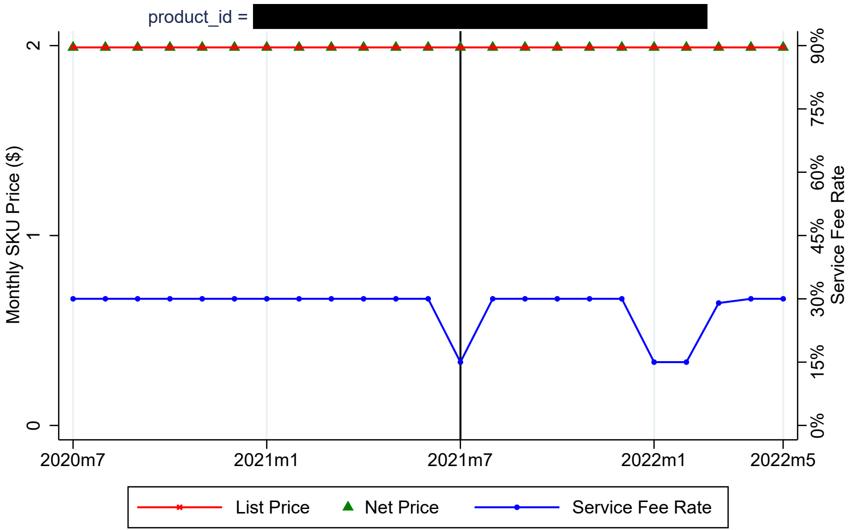
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 43.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 44.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 80% (for the corresponding app developer).

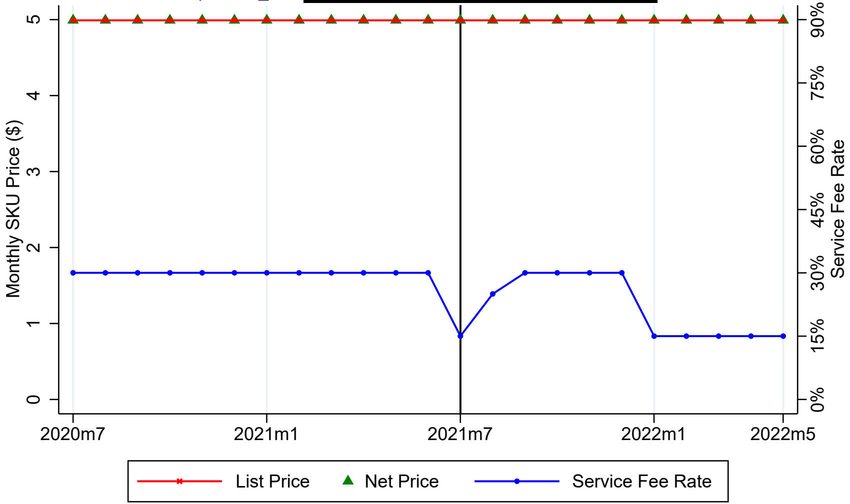
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 46.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 100% (for the corresponding app developer).



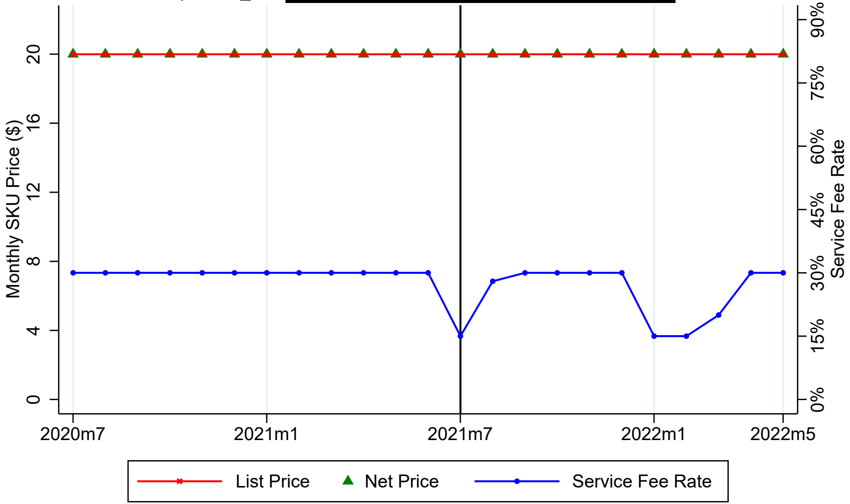
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 47.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 48.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category);
98% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 49.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 50.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

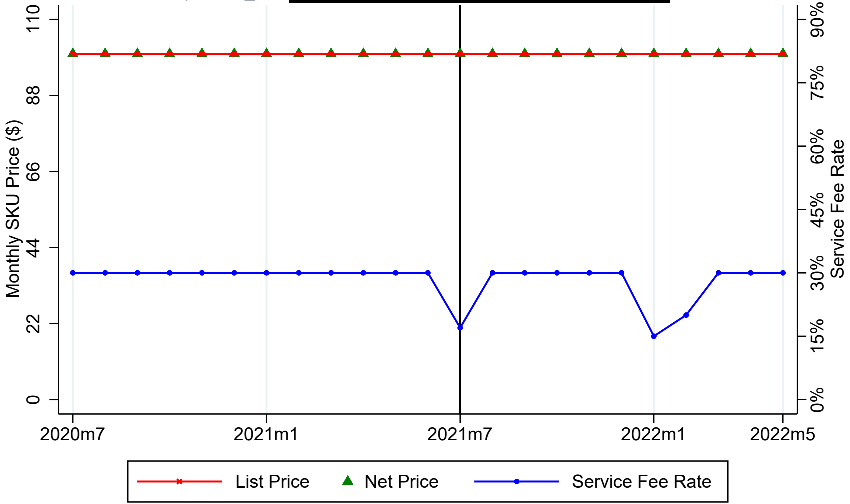
[redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 52.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

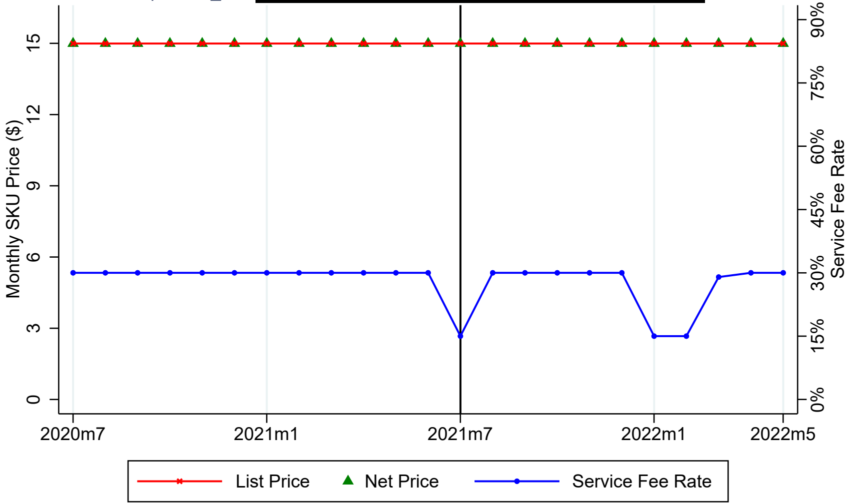
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 53.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 92% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 54.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category);
99% (for the corresponding app developer).

product_id = [redacted]

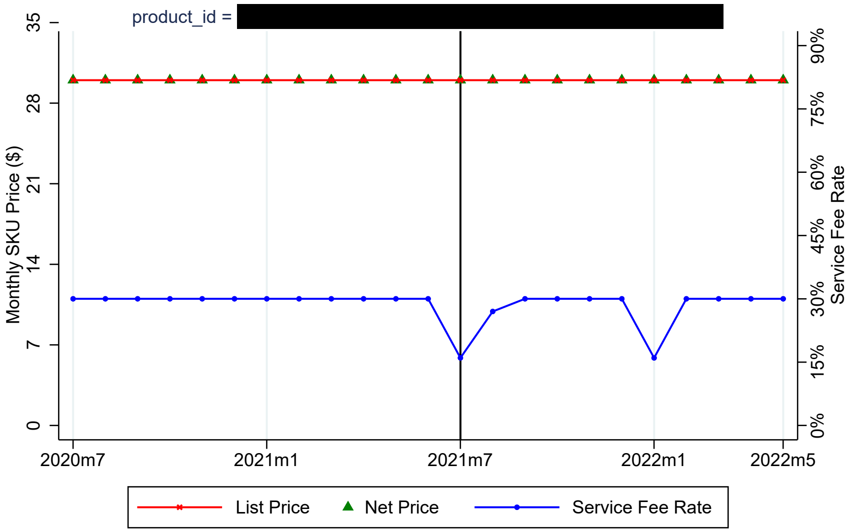


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 55.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 99% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 56.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 57.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category);
99% (for the corresponding app developer).

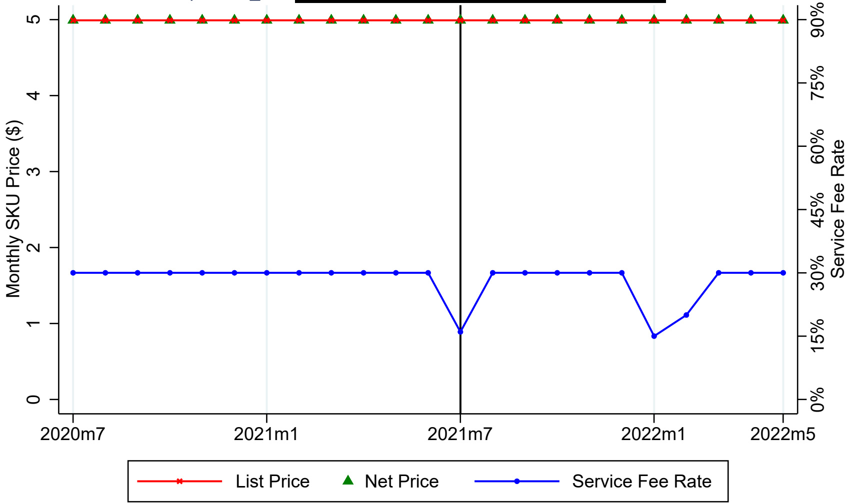


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 58.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

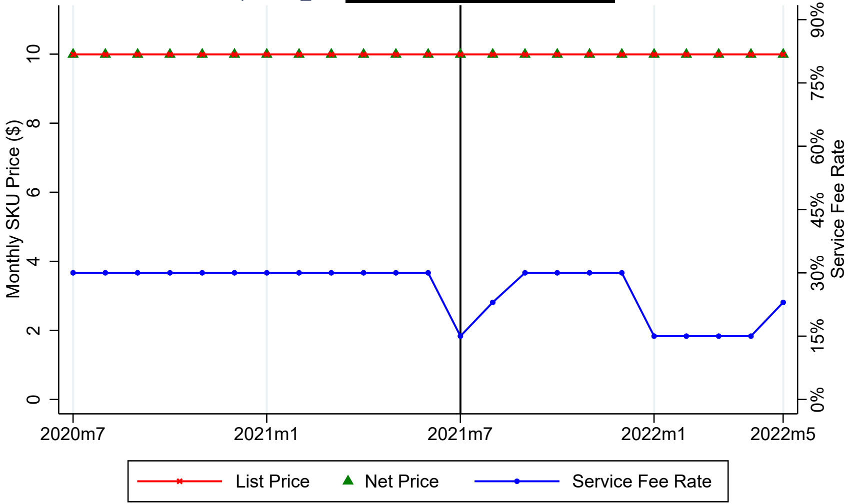
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 59.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 60.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 99% (for the corresponding app developer).

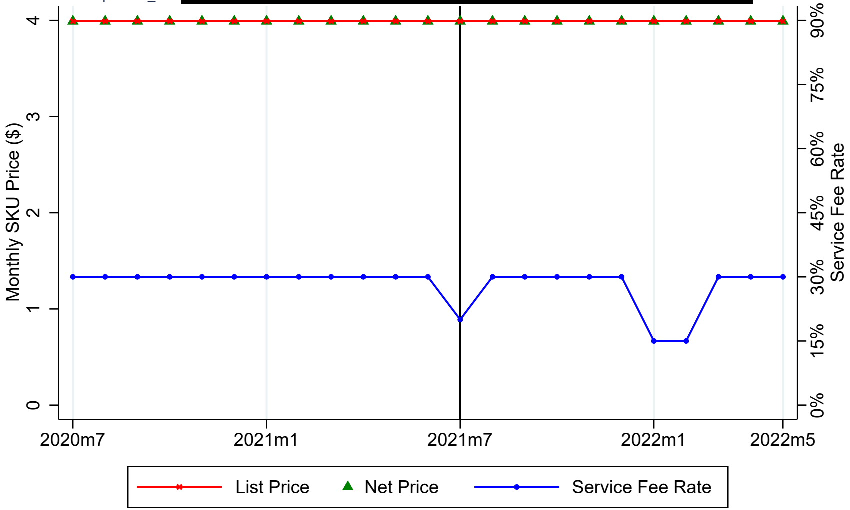
product_id = [redacted]



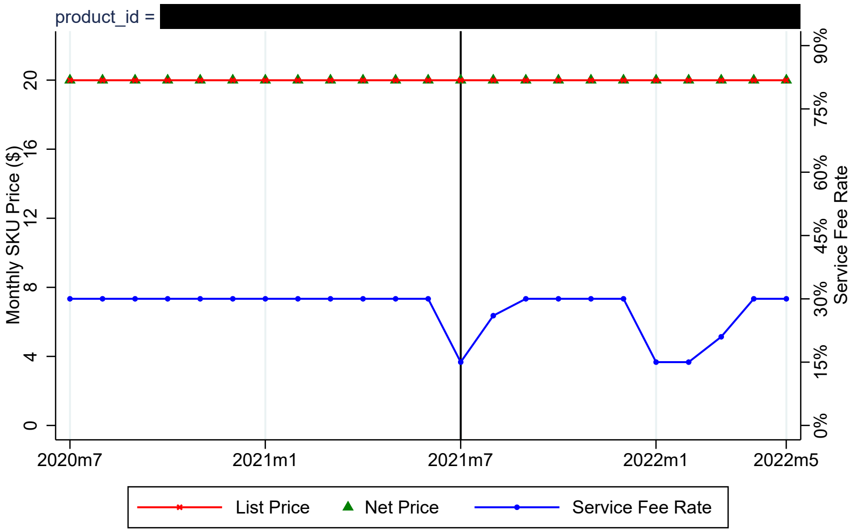
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 62.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 62% (for the corresponding app category); 97% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 63.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

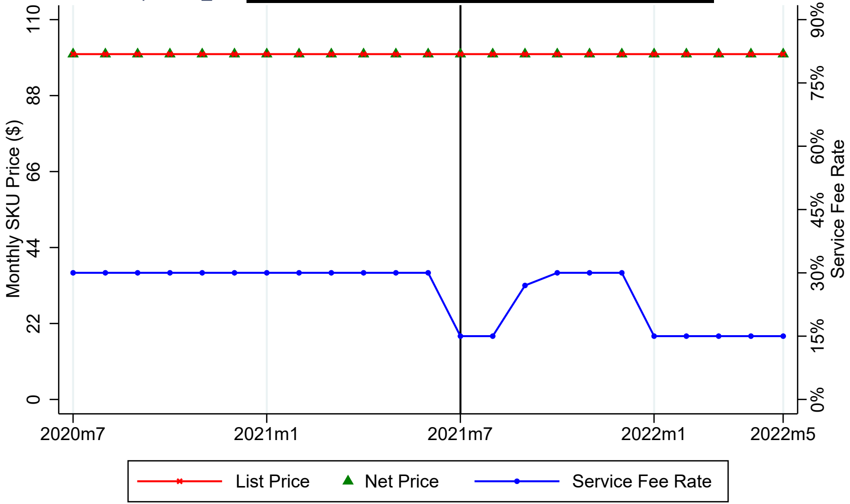


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 64.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 78% (for the corresponding app developer).



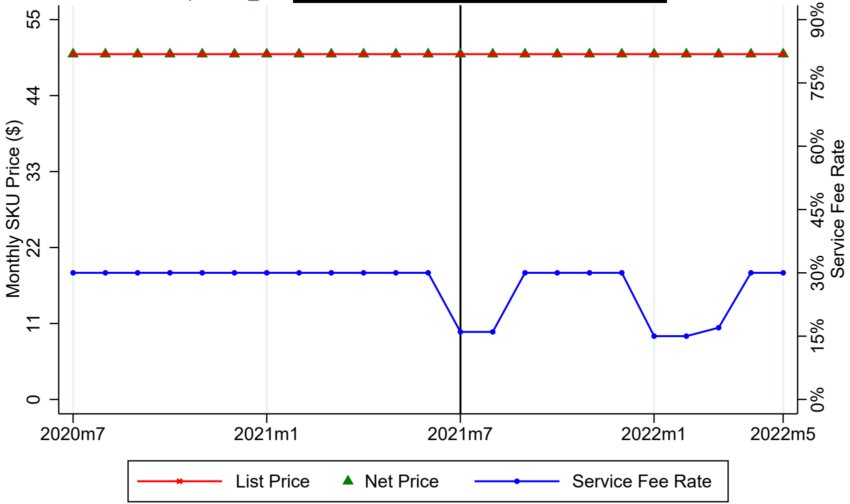
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 65.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



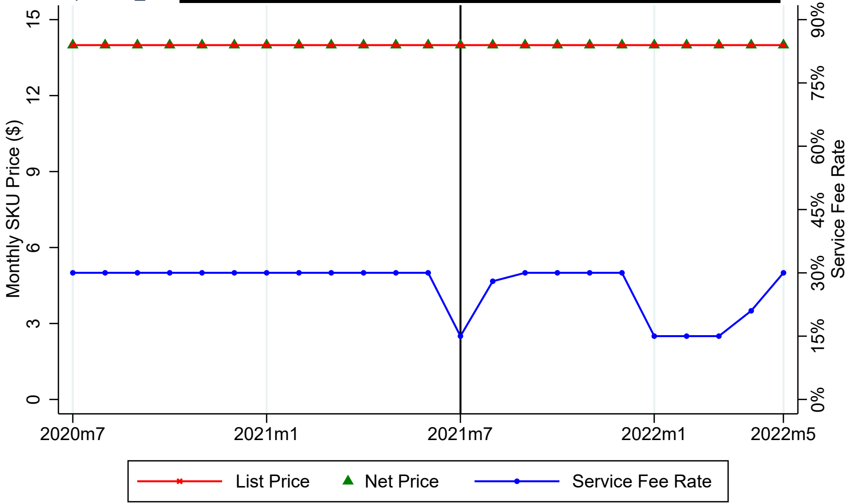
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 66.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 67.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]

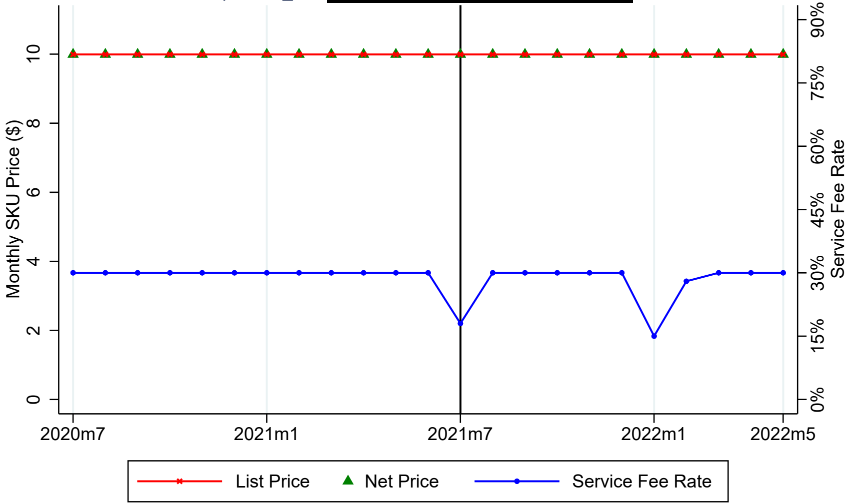


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 68.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

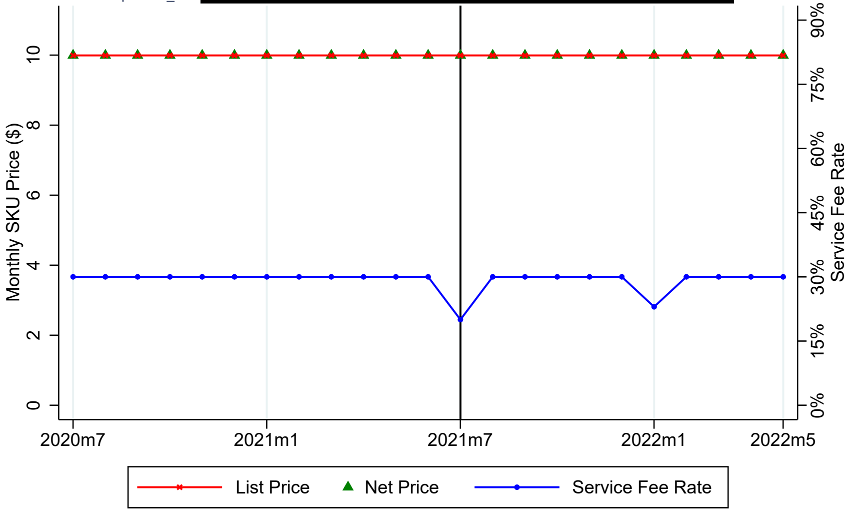
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 69.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 60% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]



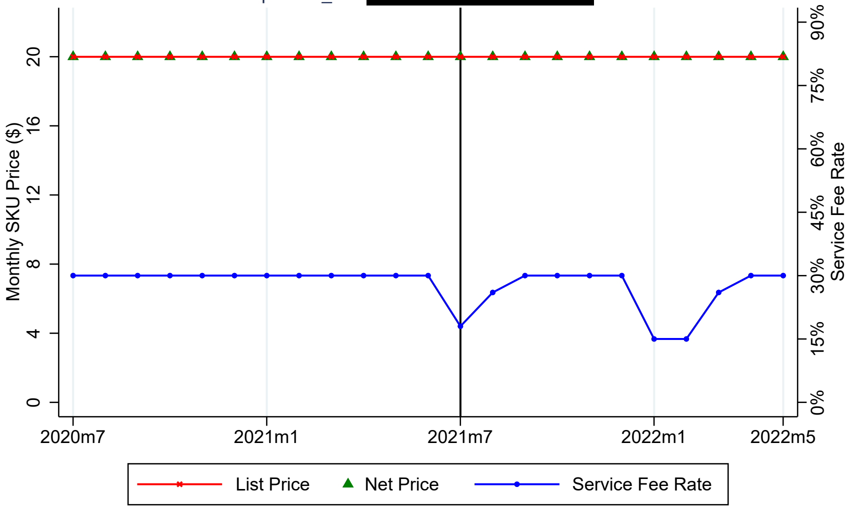
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 71.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



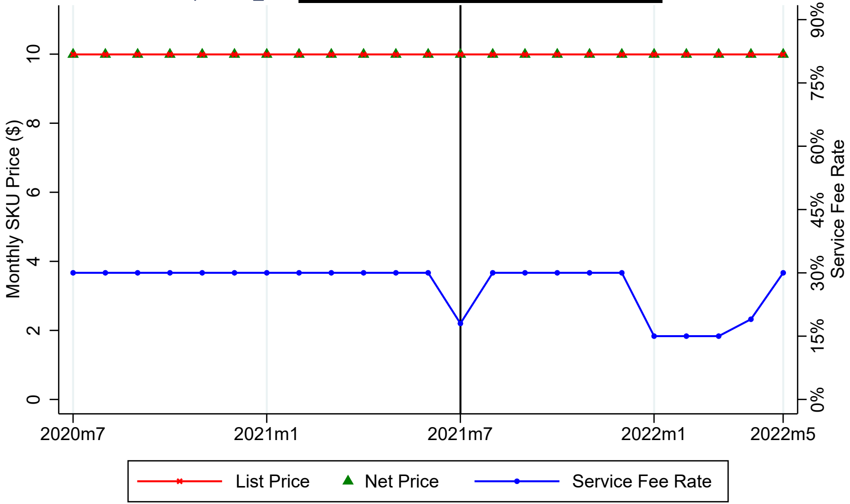
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 73.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 74.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

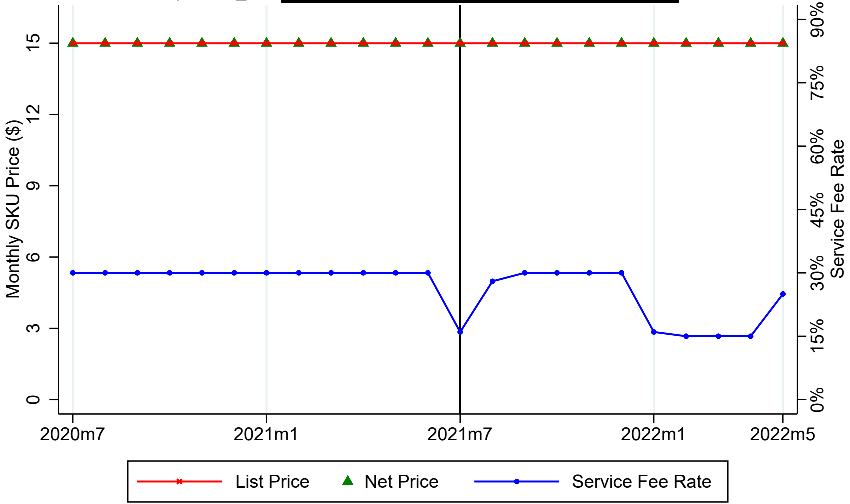


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 75.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 86% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

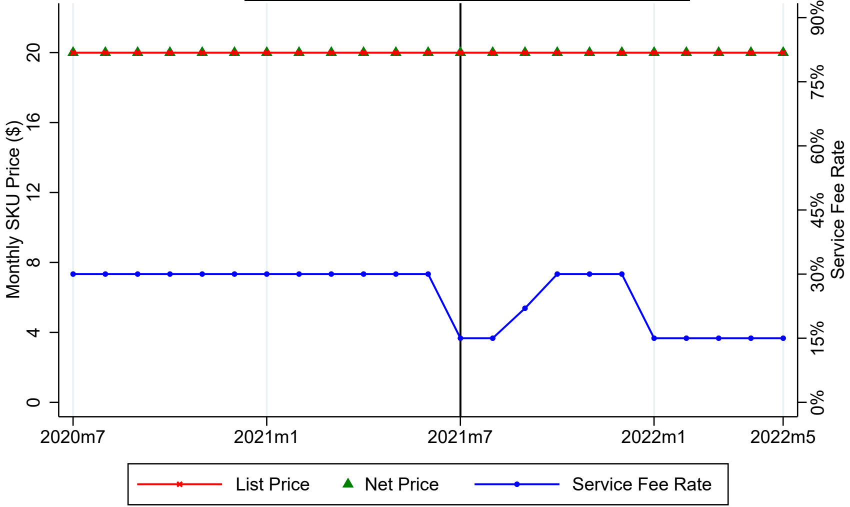
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 76.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 62% (for the corresponding app category); 97% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 77.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

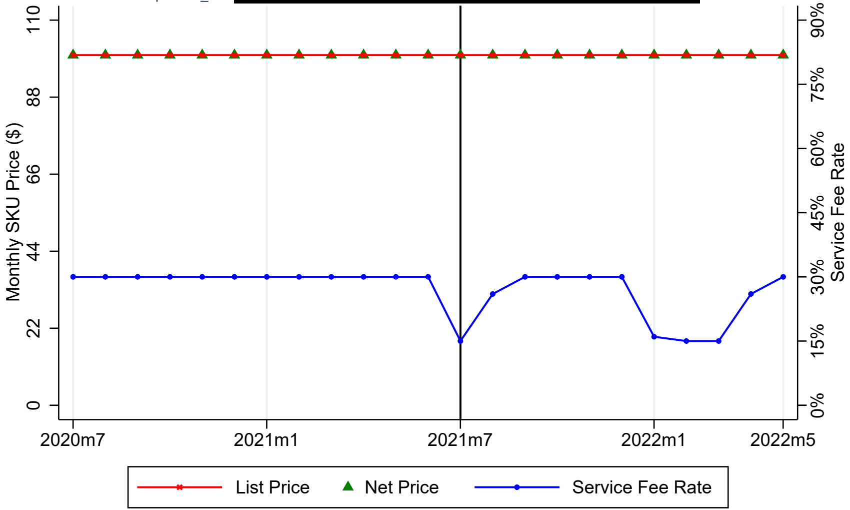


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 79.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

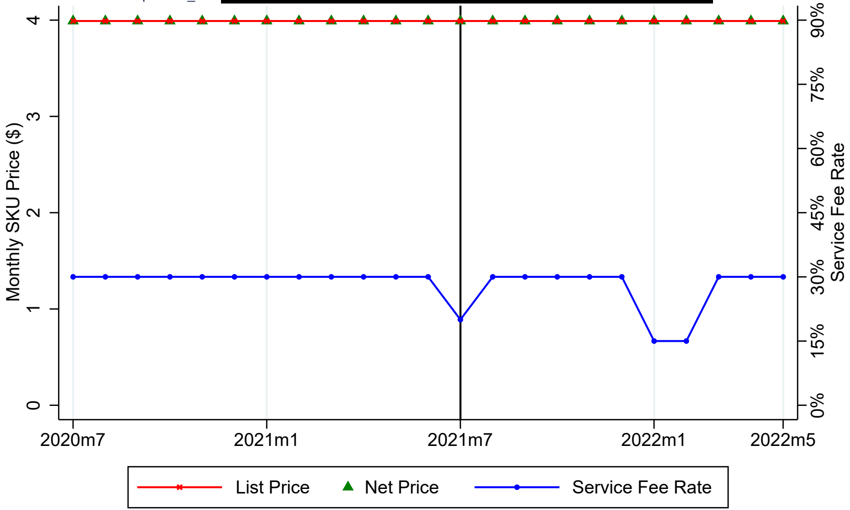
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 80.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



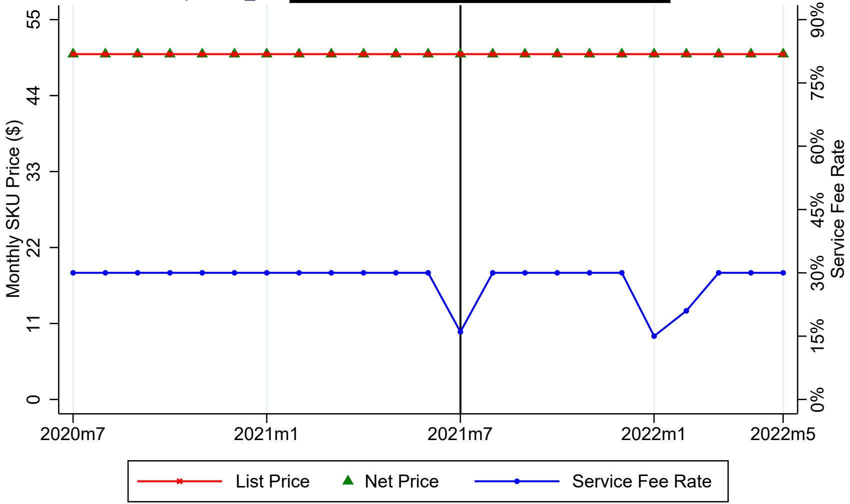
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 81.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



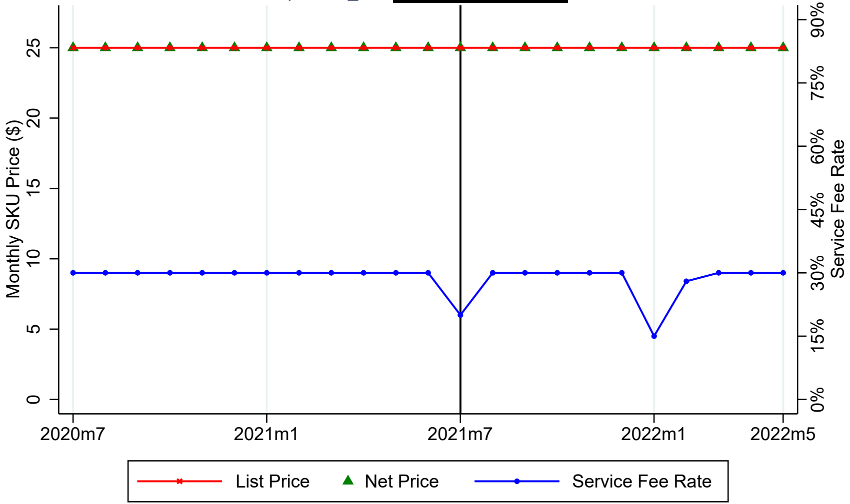
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 82.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 78% (for the corresponding app developer).

product_id = [redacted]



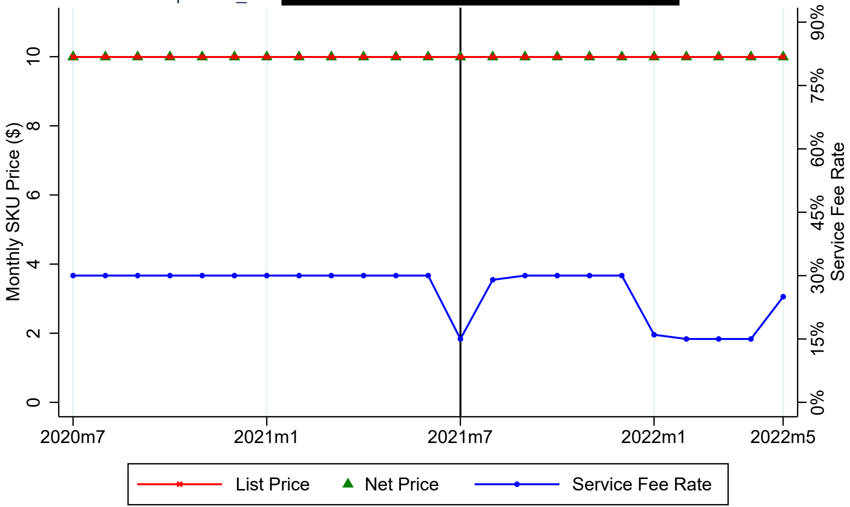
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 84.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]



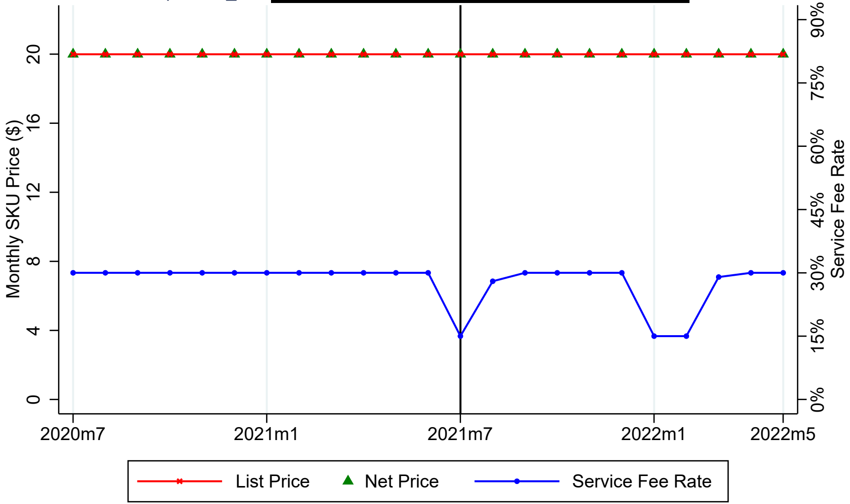
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 85.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 86.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

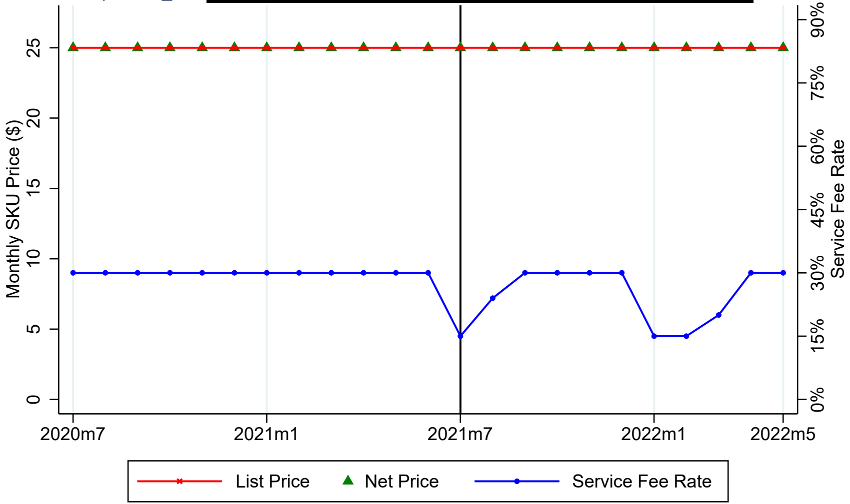


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 88.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 89.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

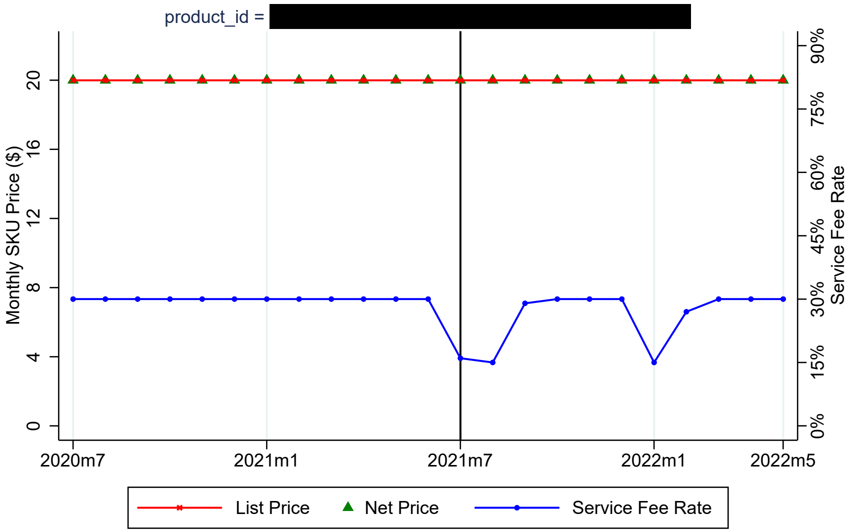


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 90.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 80% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 91.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 99% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 92.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

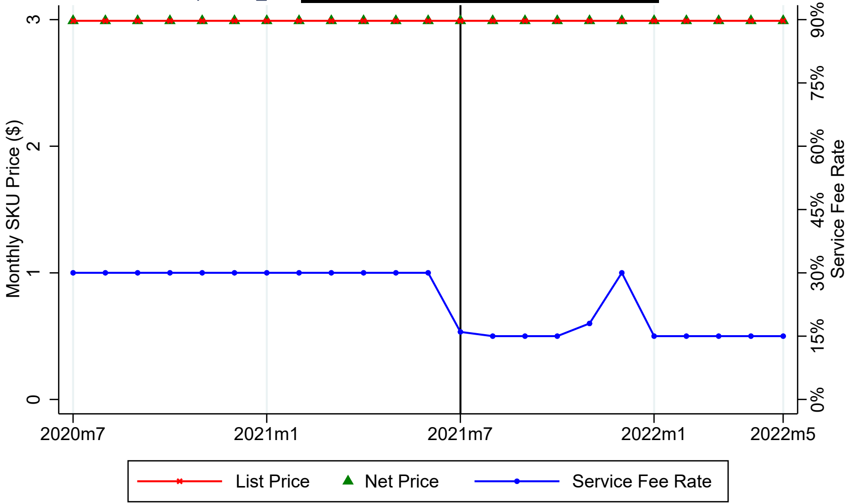


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 93.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category);
100% (for the corresponding app developer).

product_id = [redacted]

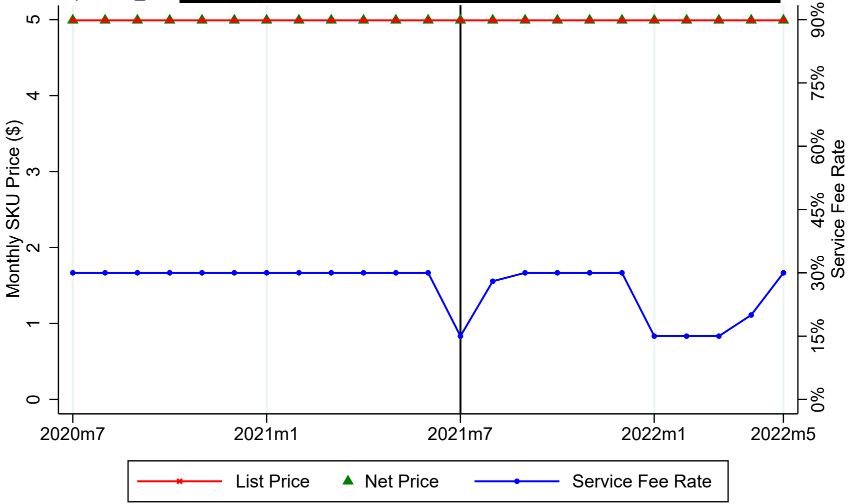
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 94.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]



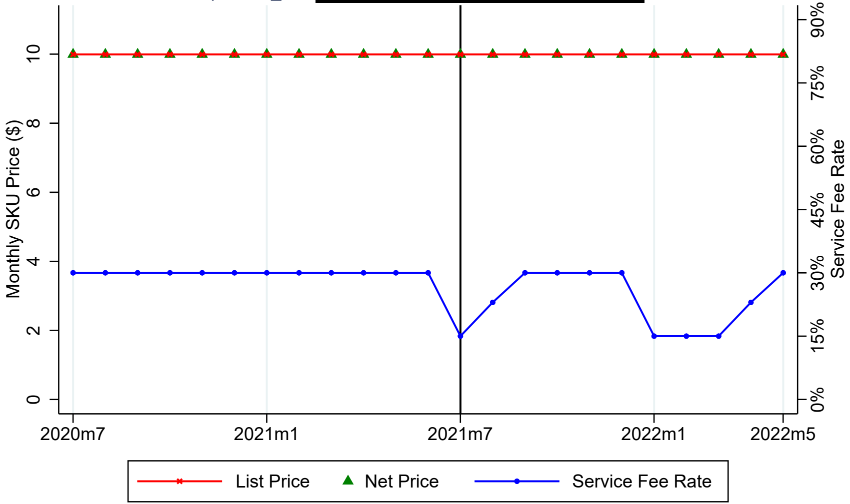
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 96.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category);
93% (for the corresponding app developer).

product_id = [redacted]

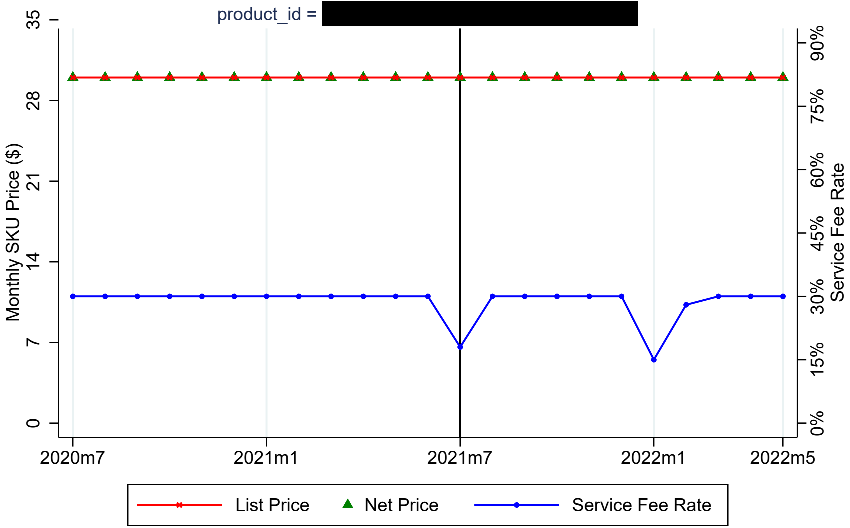


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 97.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

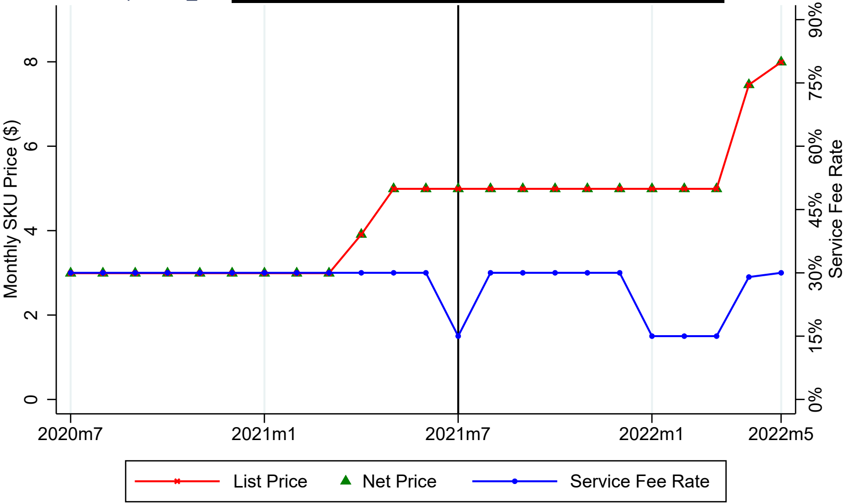


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 98.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 60% (for the corresponding app category); 97% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 99.
[2] Price change before and after July 2021: no change in list price, no change in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category);
99% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 27.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 45.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 61.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 92% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 70.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 79% (for the corresponding app category); 97% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 72.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category);
100% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 83.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 100% (for the corresponding app developer).

product_id = [redacted]

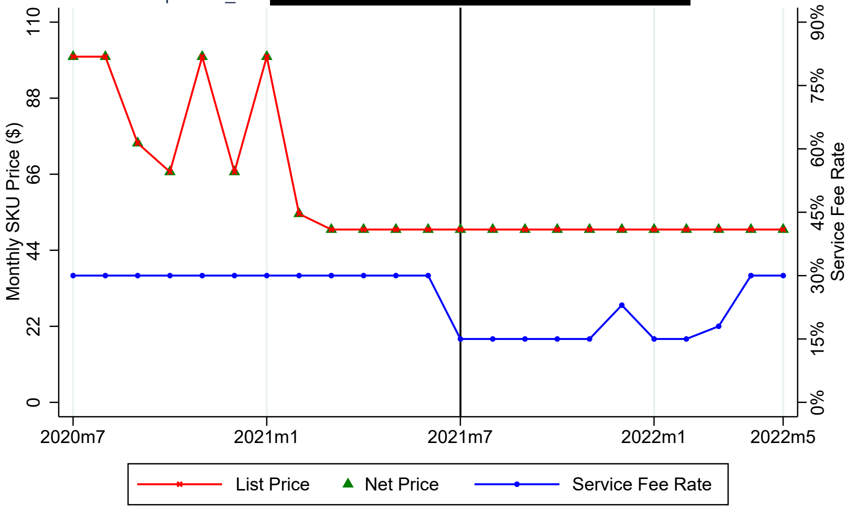
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 87.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category);
99% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 95.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 100.
[2] Price change before and after July 2021: increase in list price, increase in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 99% (for the corresponding app developer).

product_id = [redacted]

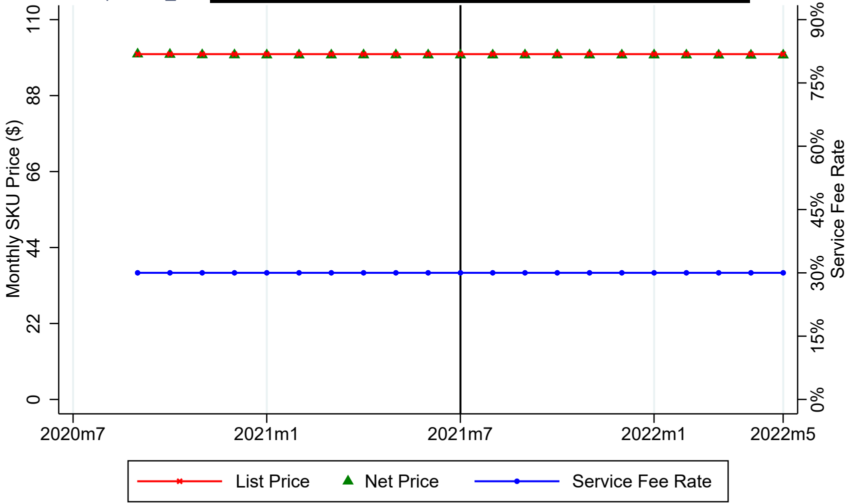


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 78.
[2] Price change before and after July 2021: decrease in list price, decrease in net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 100% (for the corresponding app developer).

Exhibit 36c

Average Monthly Product Price and Service Fee Rate for the Top 100 IAPs

product_id = [redacted]

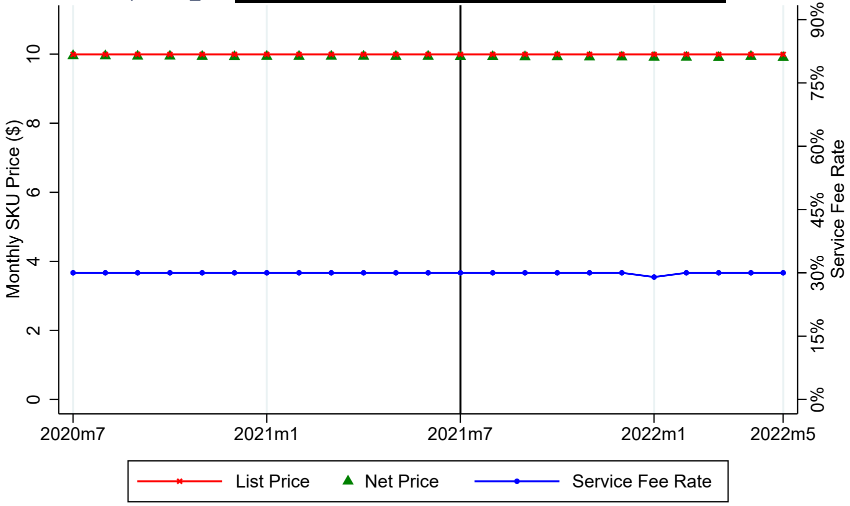


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 1.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 94% (for the corresponding app developer).

product_id = [redacted]

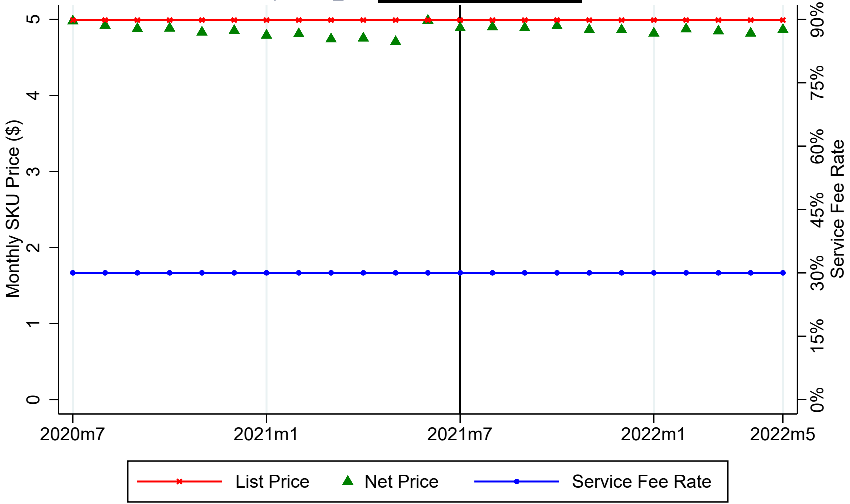
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 2.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 53% (for the corresponding app developer).

product_id = [redacted]

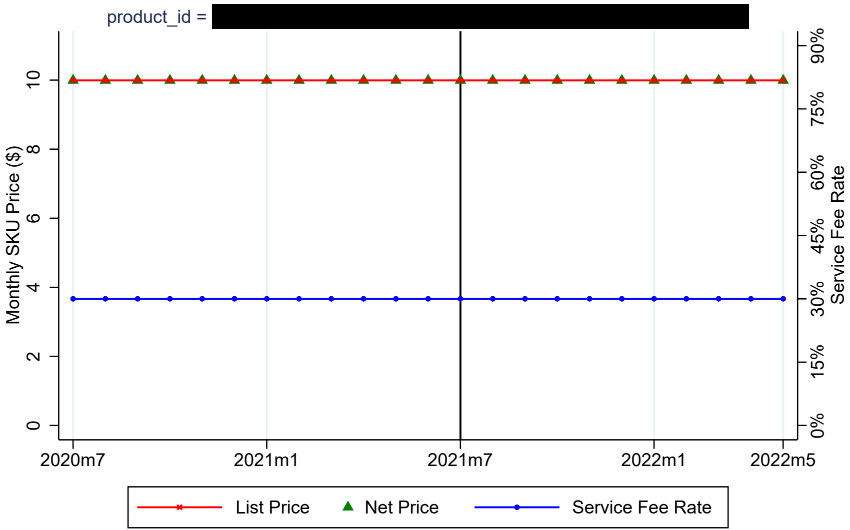


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 3.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category);
53% (for the corresponding app developer).

product_id = [redacted]

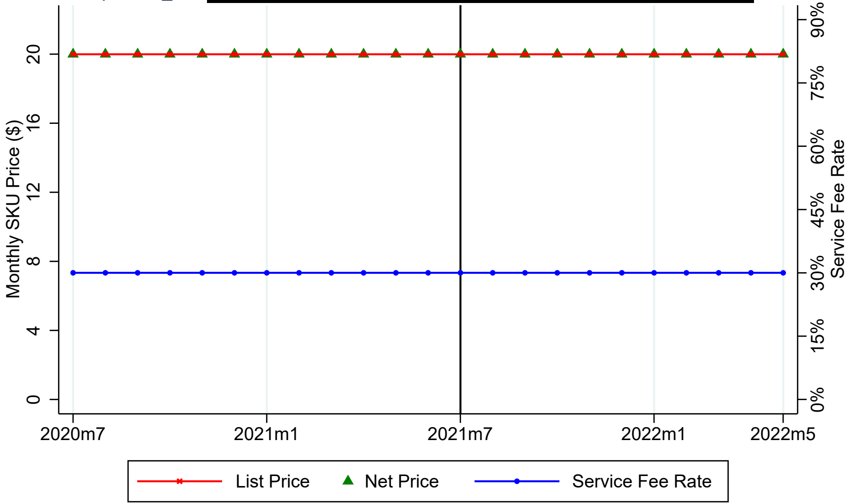


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 4.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 55% (for the corresponding app developer).



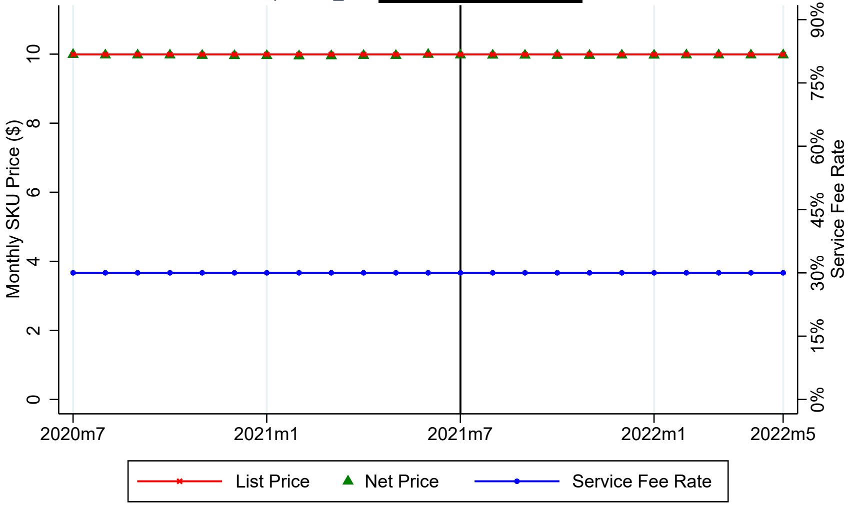
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 5.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 64% (for the corresponding app developer).

product_id = [redacted]



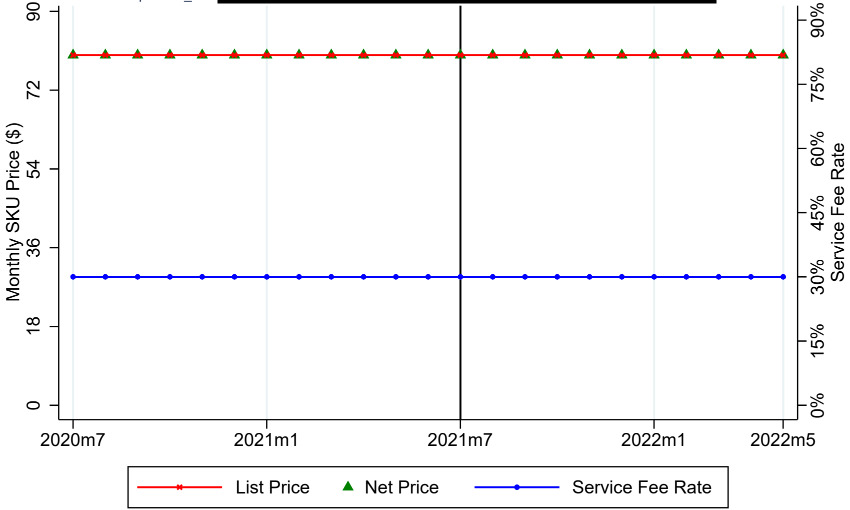
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 6.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 64% (for the corresponding app developer).

product_id = [redacted]



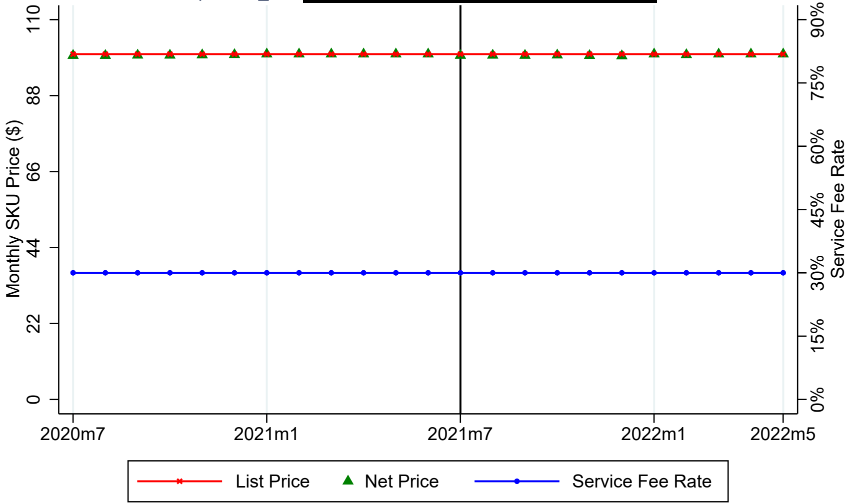
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 7.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 55% (for the corresponding app developer).

product_id = [redacted]



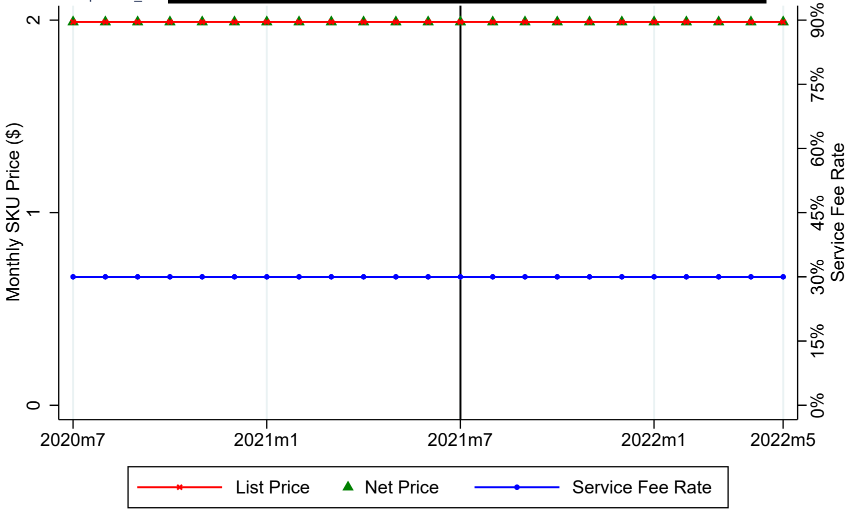
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 8.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 98% (for the corresponding app developer).

product_id = [redacted]

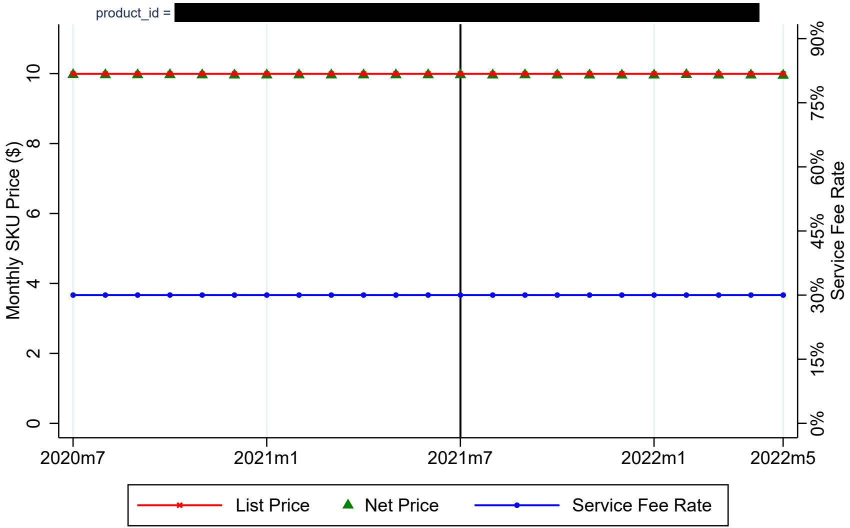


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 9.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 86% (for the corresponding app developer).

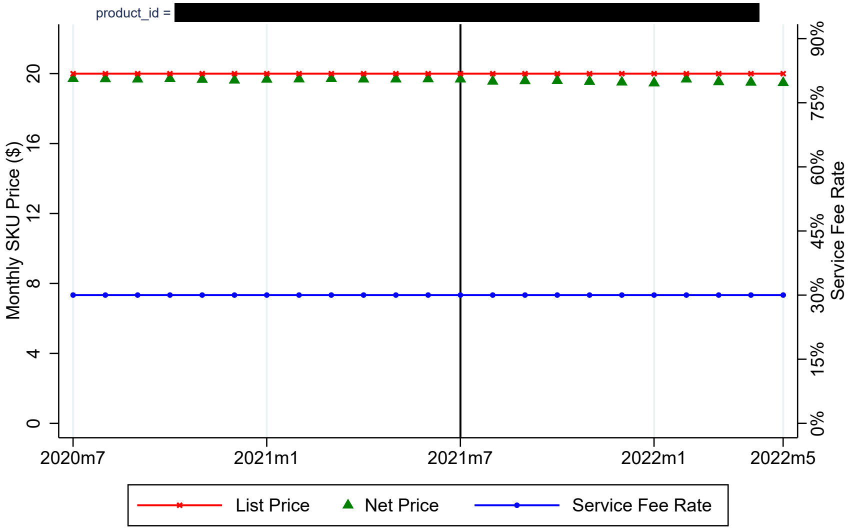
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 10.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

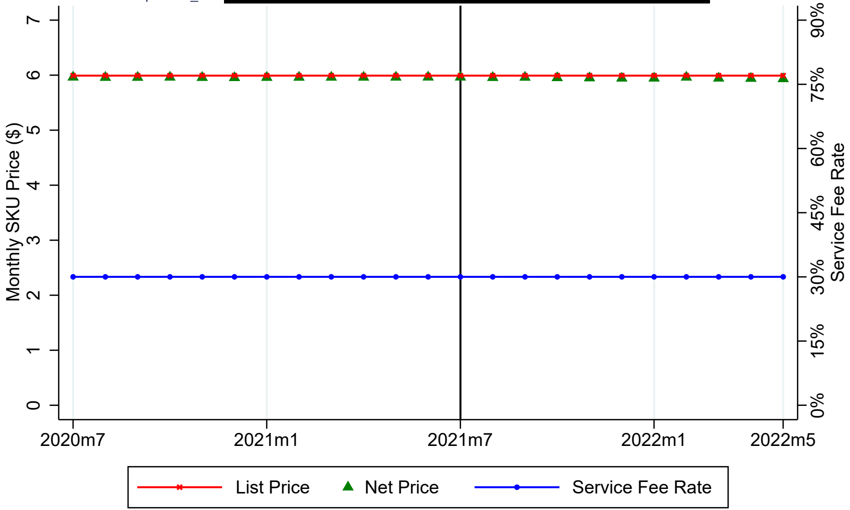


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 11.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category);
39% (for the corresponding app developer).



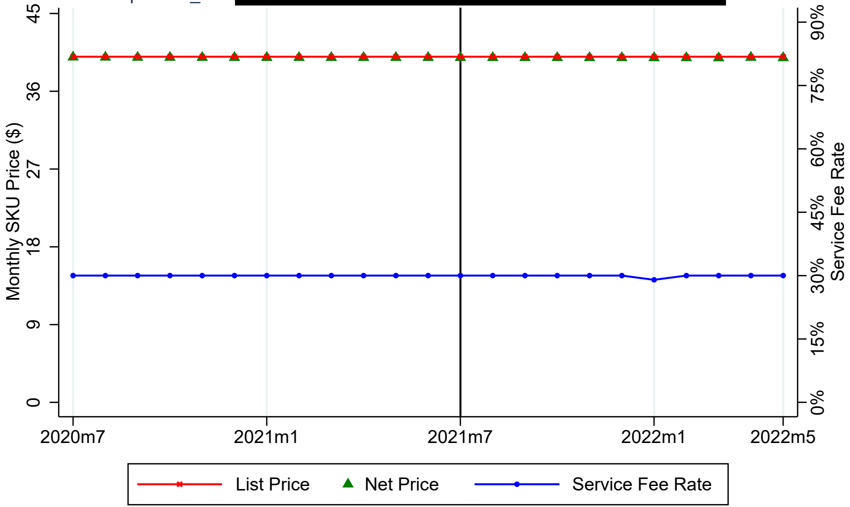
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 12.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

product_id = [redacted]

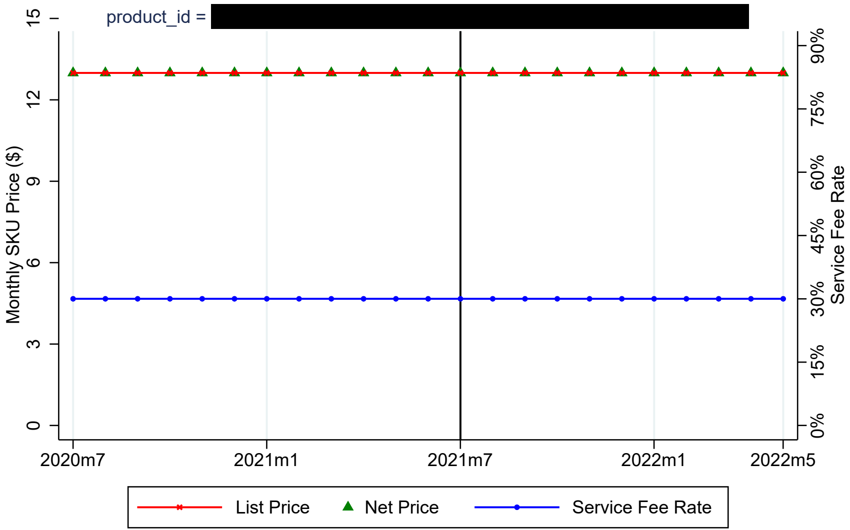


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 13.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

product_id = [redacted]

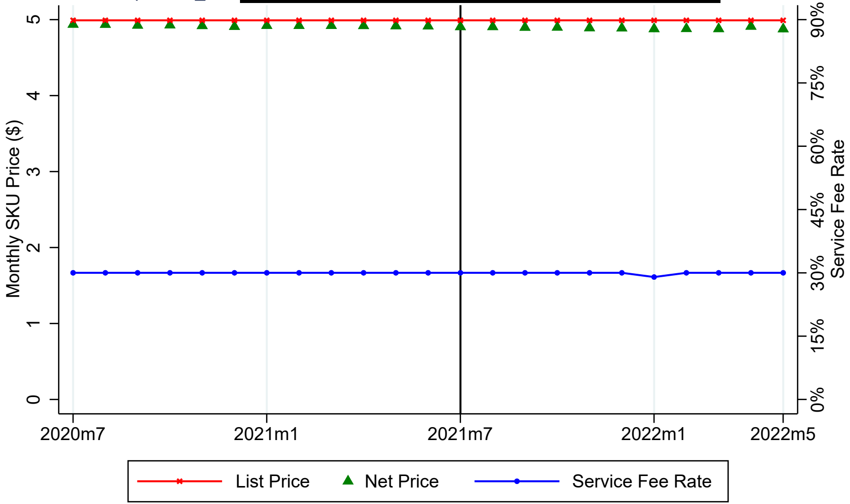


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 14.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 53% (for the corresponding app developer).



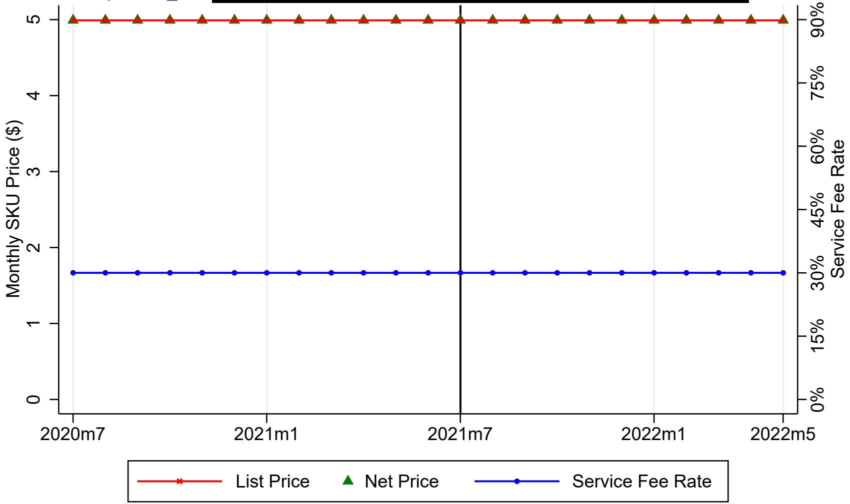
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 15.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 81% (for the corresponding app developer).

product_id = [redacted]

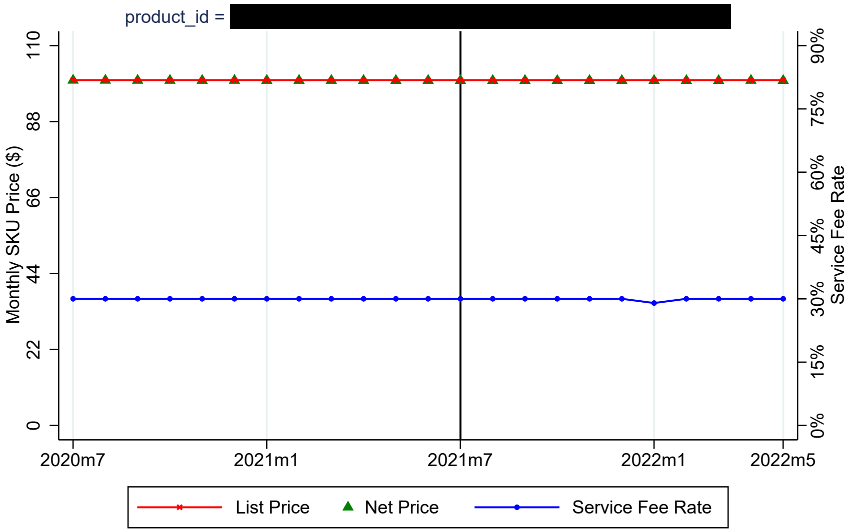


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 17.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 53% (for the corresponding app developer).

product_id = [redacted]

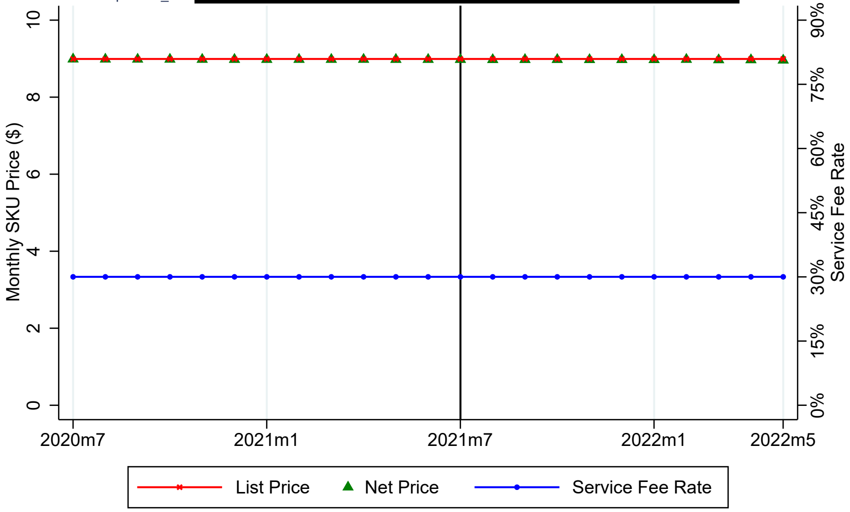


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 18.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 64% (for the corresponding app developer).



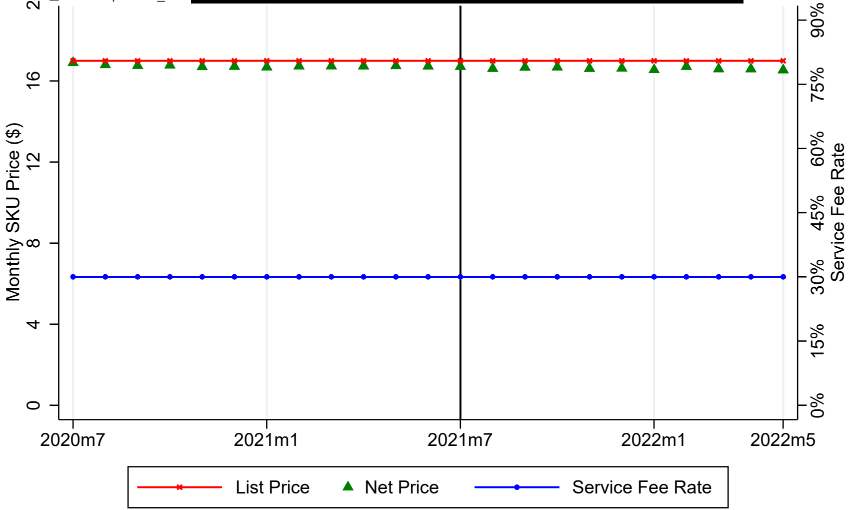
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 19.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 53% (for the corresponding app developer).

product_id = [redacted]



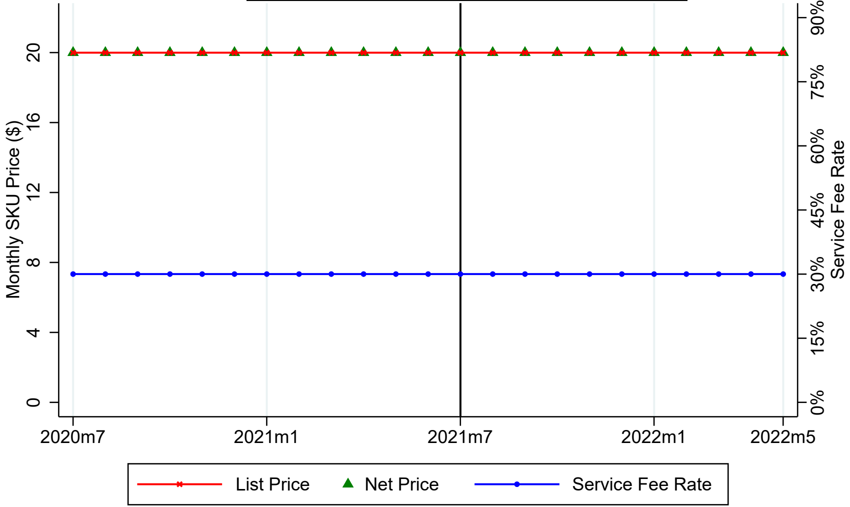
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 21.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

product_id = [redacted]



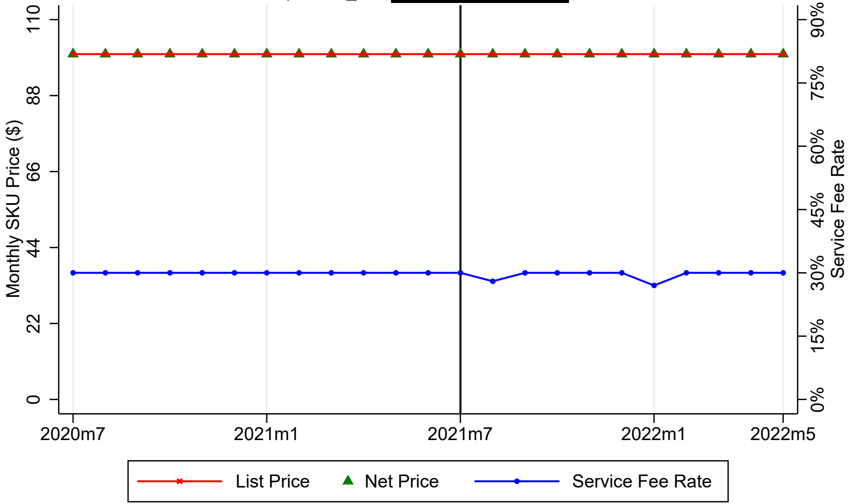
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 22.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

product_id = [redacted]

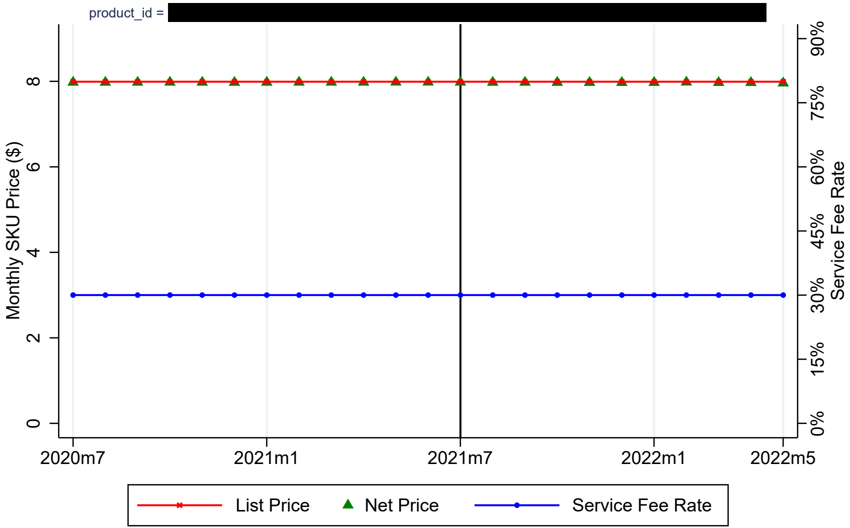


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 23.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 72% (for the corresponding app developer).

product_id = [redacted]

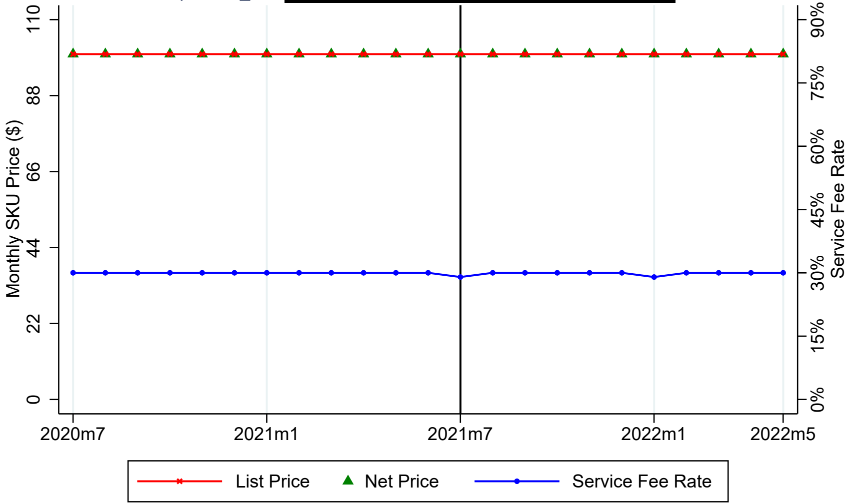


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 24.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 96% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 25.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 26.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

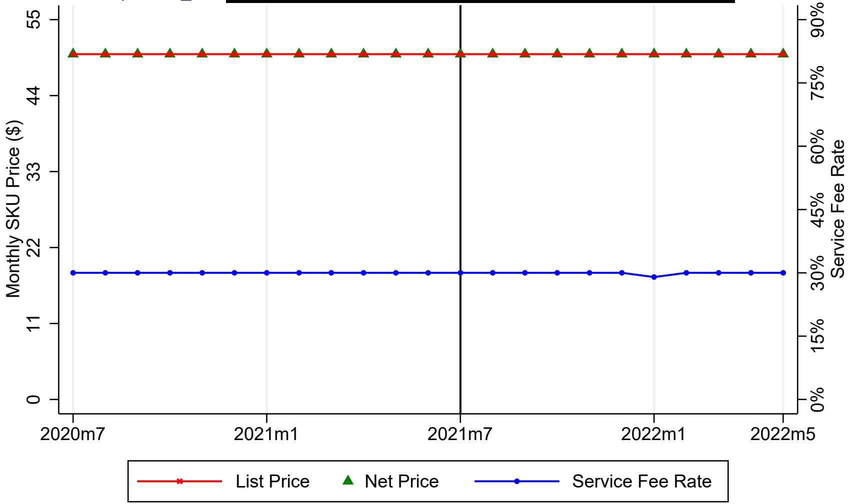
[redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 28.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 74% (for the corresponding app developer).

product_id = [redacted]

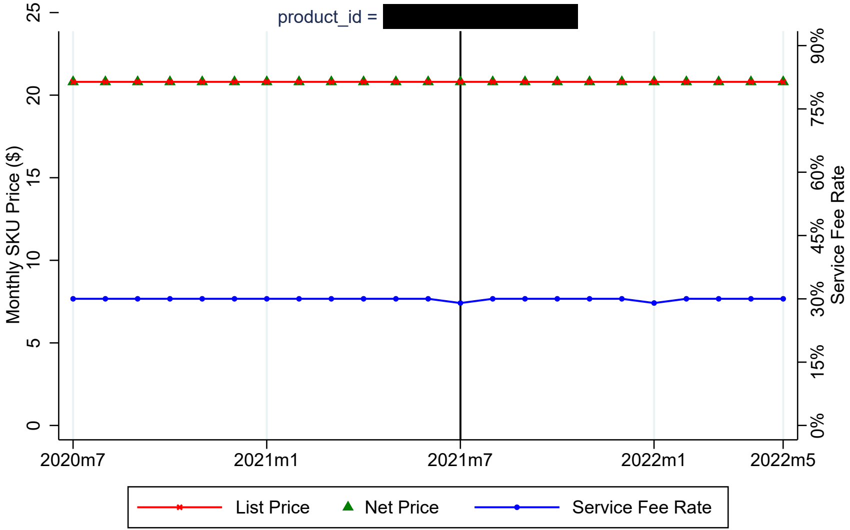
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 29.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 74% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 30.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category);
96% (for the corresponding app developer).

product_id = [redacted]

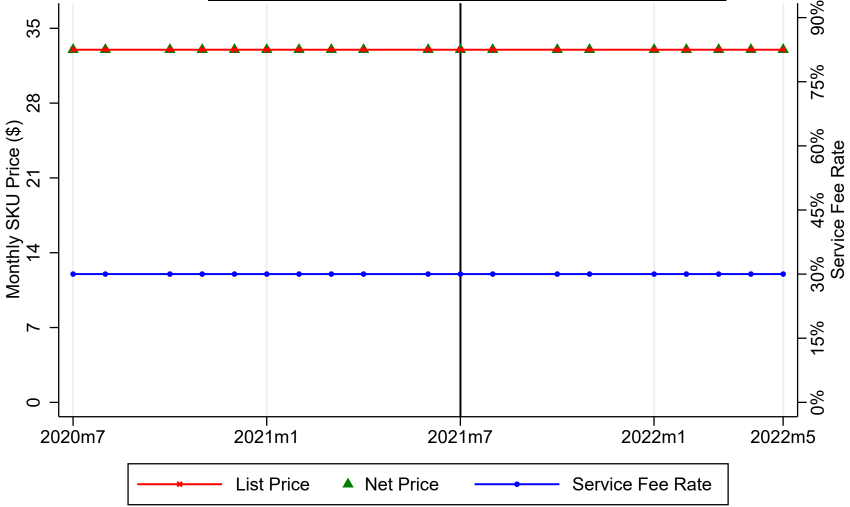


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 31.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 84% (for the corresponding app developer).

product_id = [redacted]

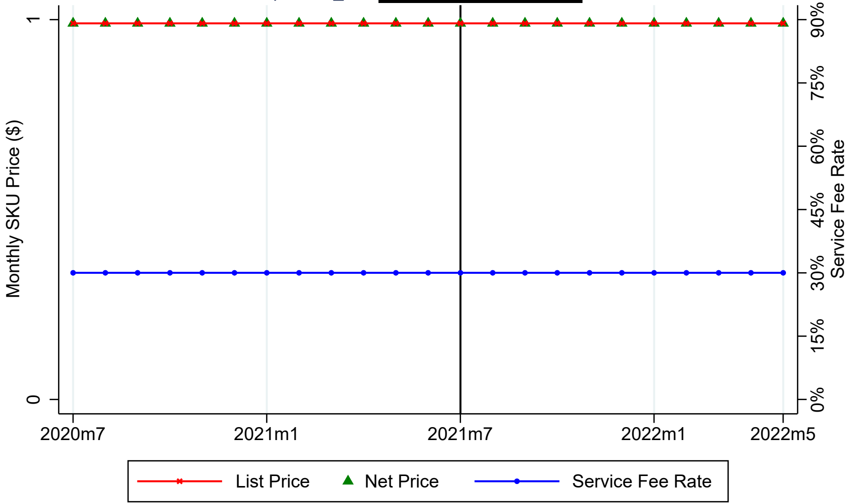
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 32.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 74% (for the corresponding app developer).

product_id = [redacted]



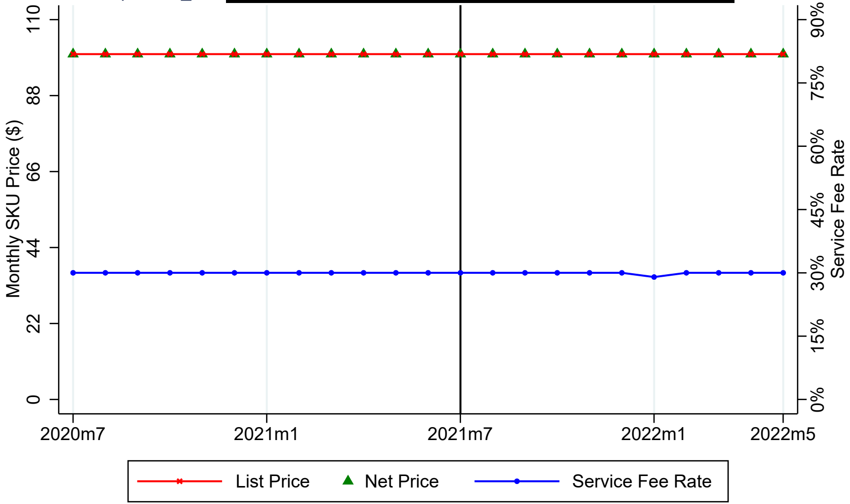
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 33.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 88% (for the corresponding app developer).

product_id = [redacted]



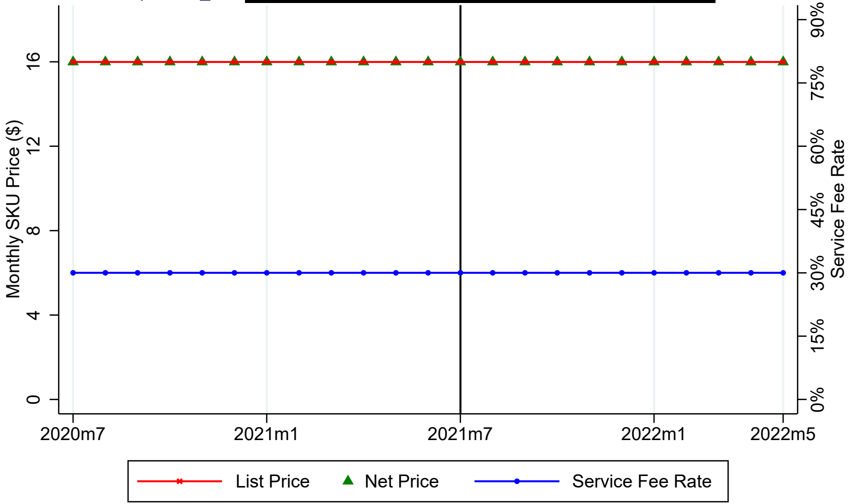
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 34.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 55% (for the corresponding app developer).

product_id = [redacted]



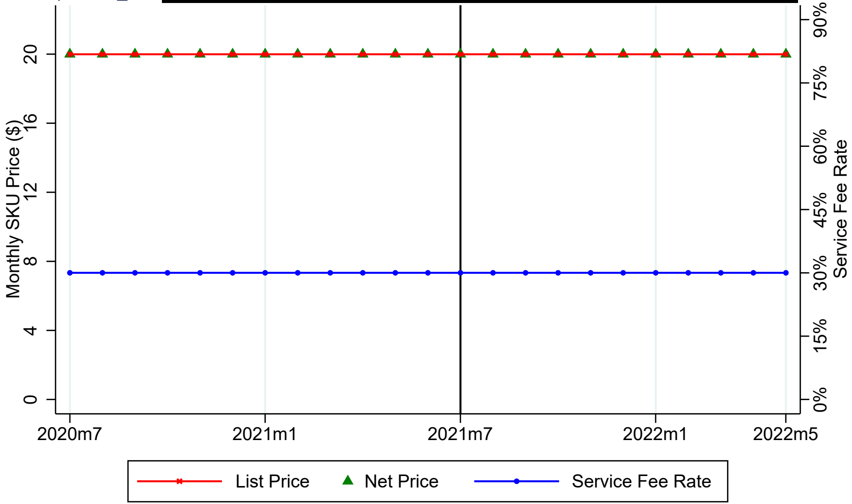
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 35.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



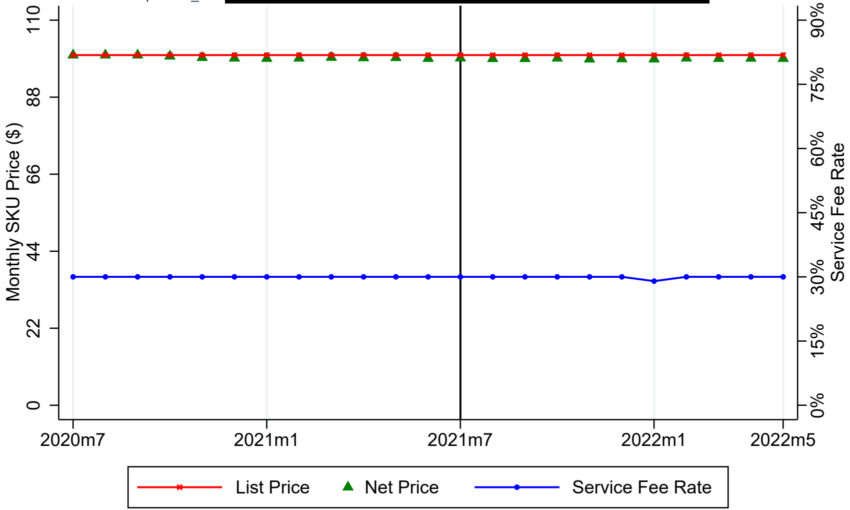
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 36.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 74% (for the corresponding app developer).

product_id = [redacted]



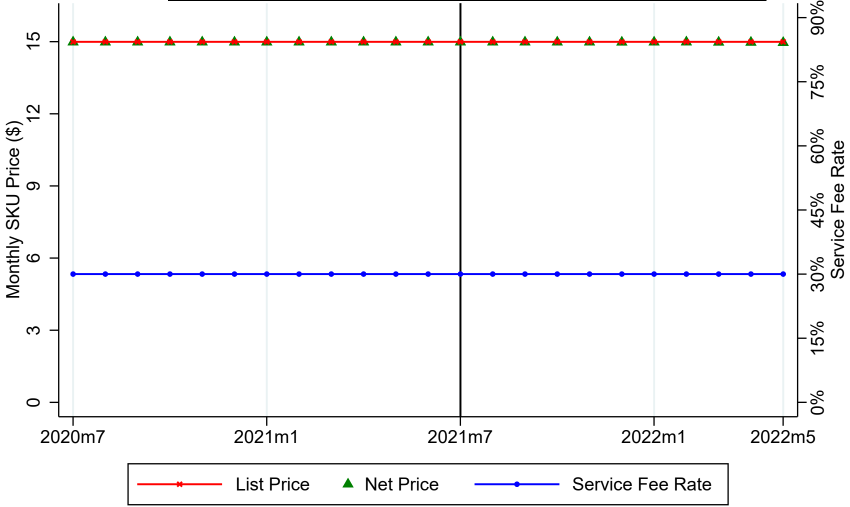
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 37.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category);
96% (for the corresponding app developer).

product_id = [redacted]



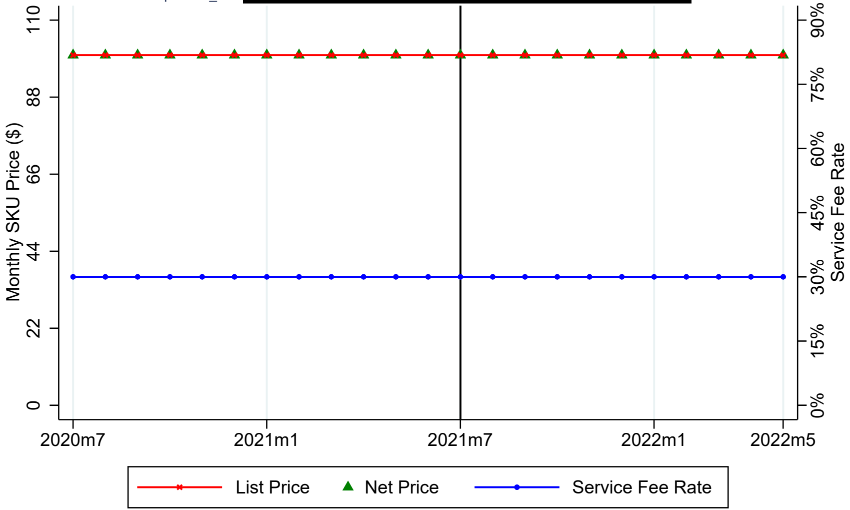
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 38.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]



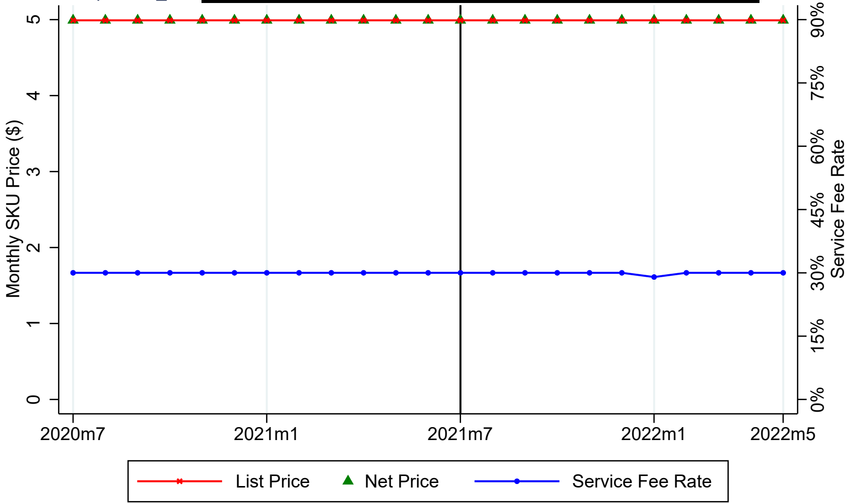
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 40.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 41.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 72% (for the corresponding app developer).

product_id = [redacted]

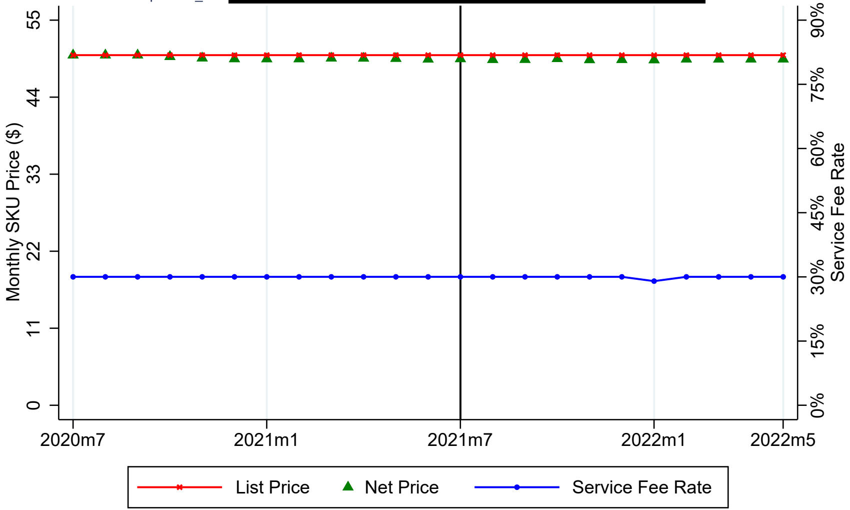


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 42.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 68% (for the corresponding app developer).

product_id = [redacted]

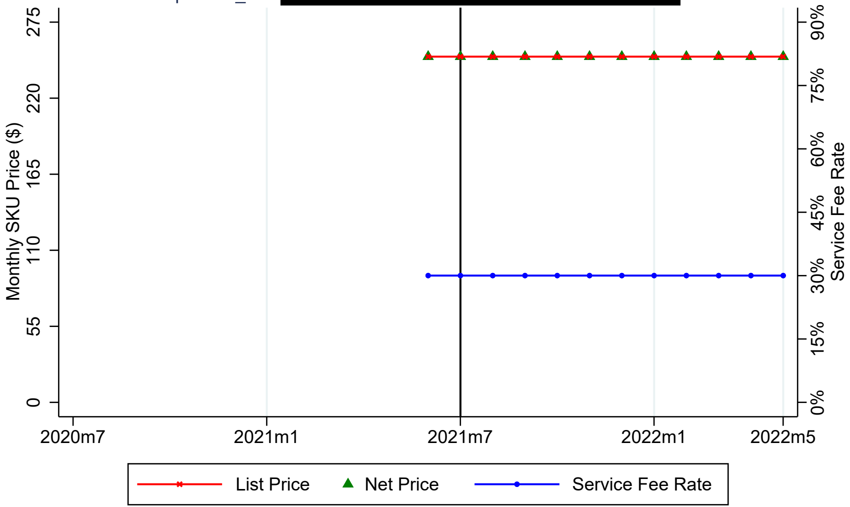
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 43.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 44.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 90% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 45.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 72% (for the corresponding app developer).

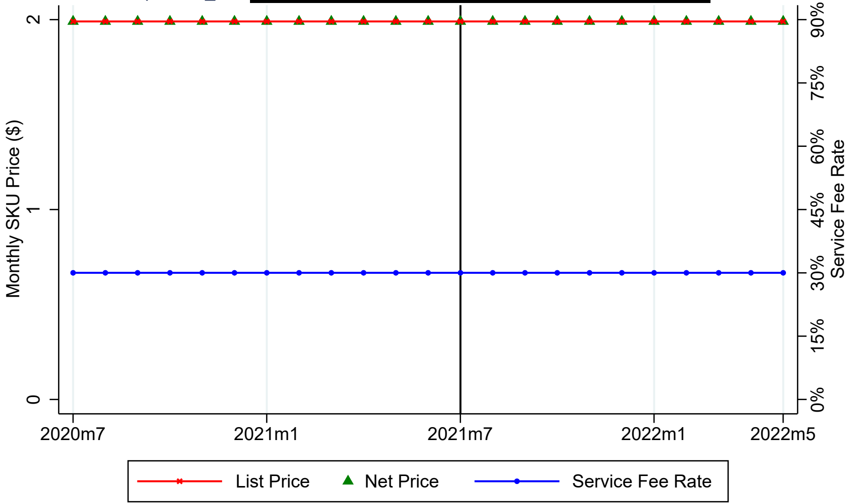
product_id = [redacted]

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 46.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 81% (for the corresponding app developer).

product_id = [redacted]

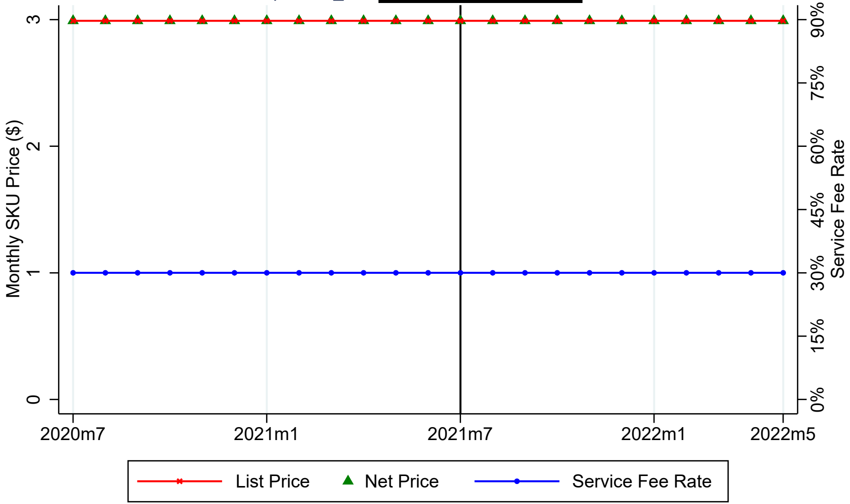
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 47.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category);
94% (for the corresponding app developer).

product_id = [redacted]



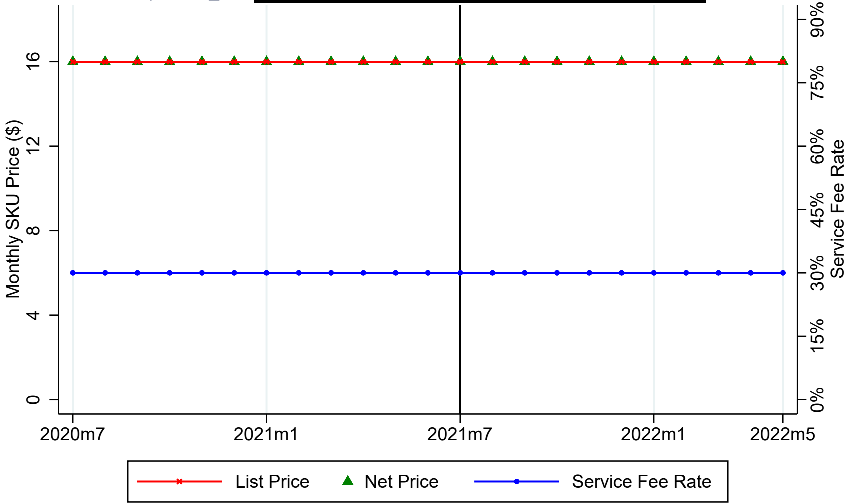
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 48.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category);
74% (for the corresponding app developer).

product_id = [redacted]



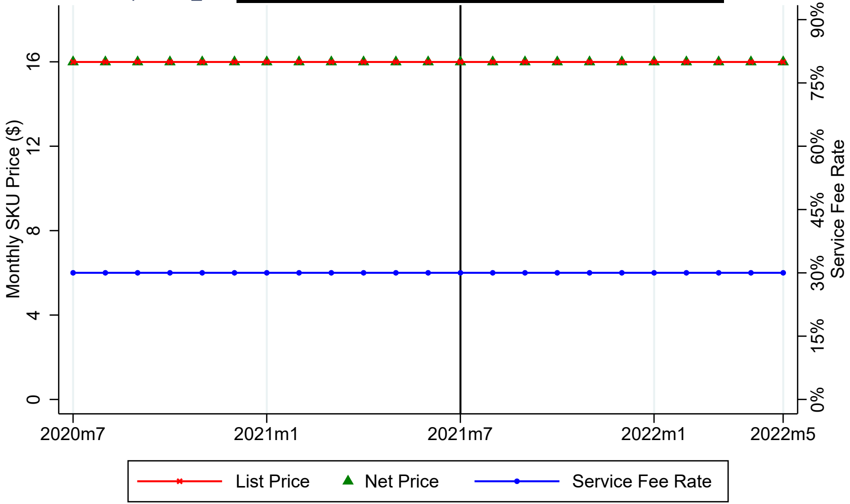
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 49.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 55% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 51.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category);
74% (for the corresponding app developer).

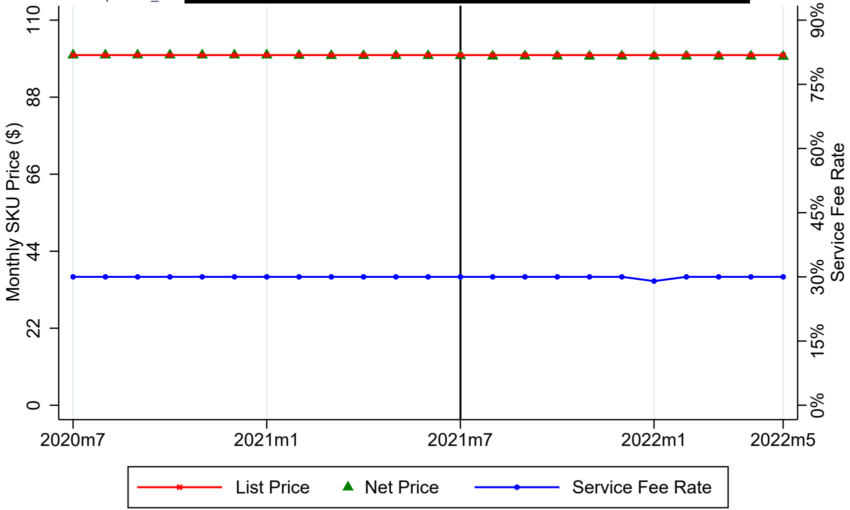
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 52.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 74% (for the corresponding app developer).

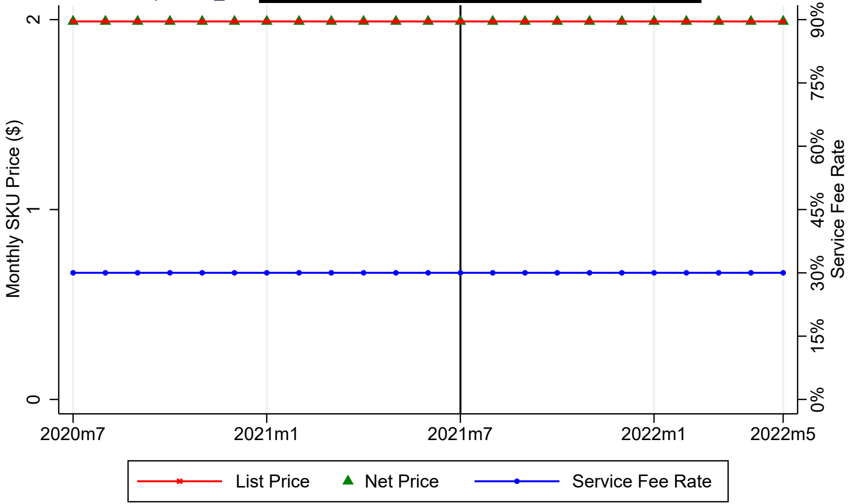
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 53.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 72% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 54.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]

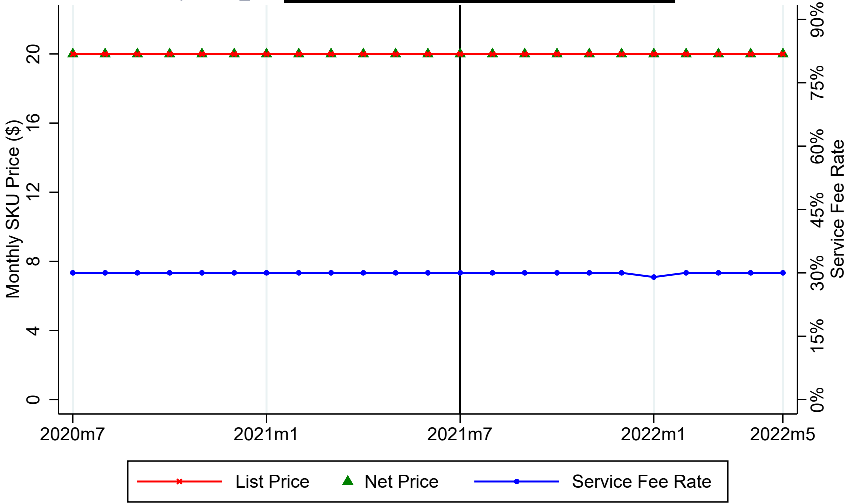


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 55.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 74% (for the corresponding app developer).

product_id = [redacted]

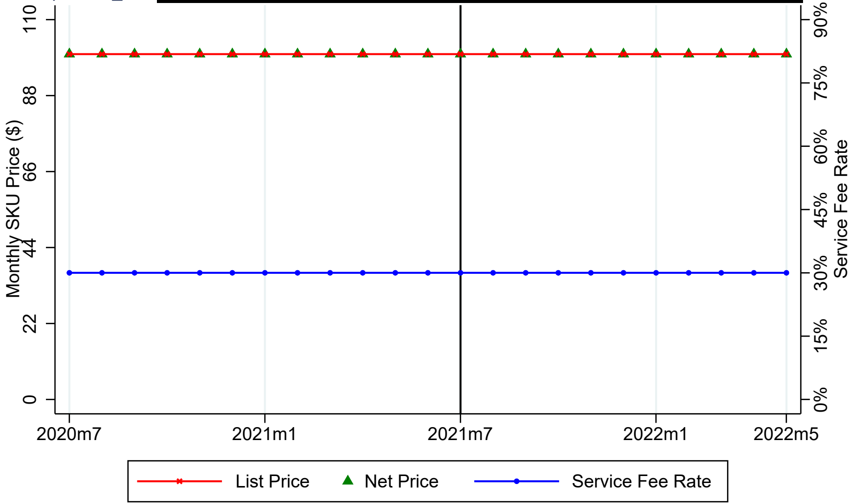
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 56.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

product_id = [redacted]



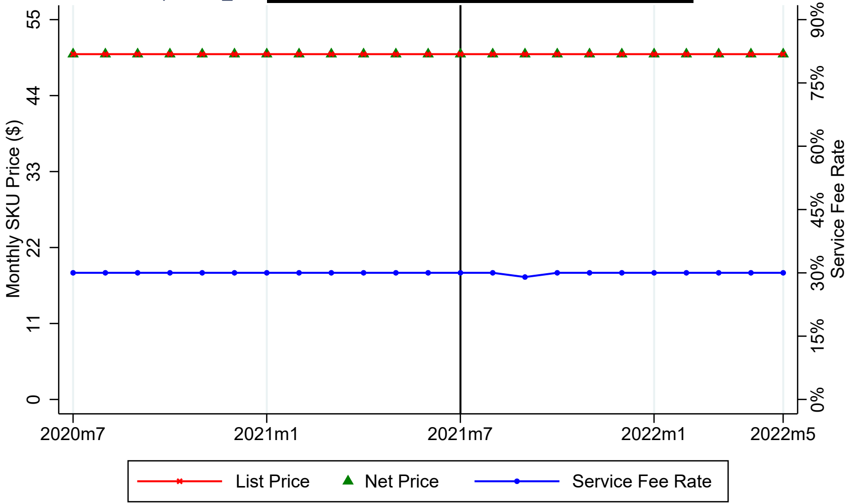
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 57.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

product_id = [redacted]



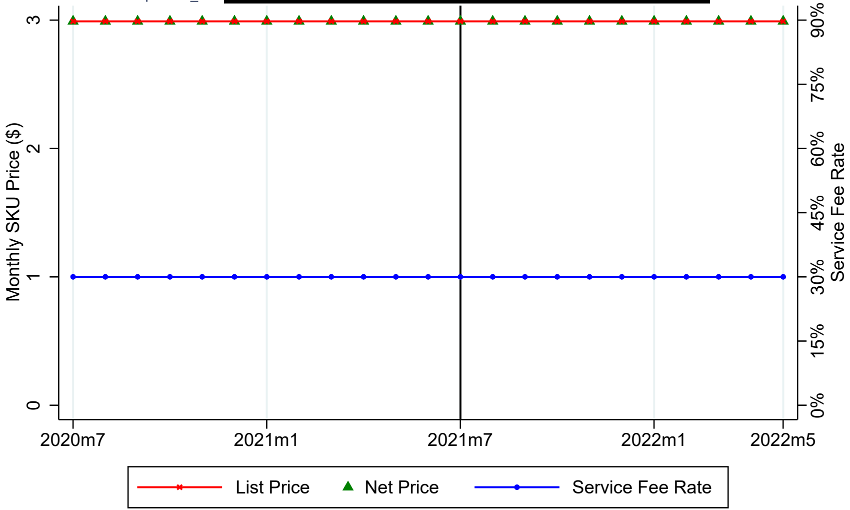
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 58.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]



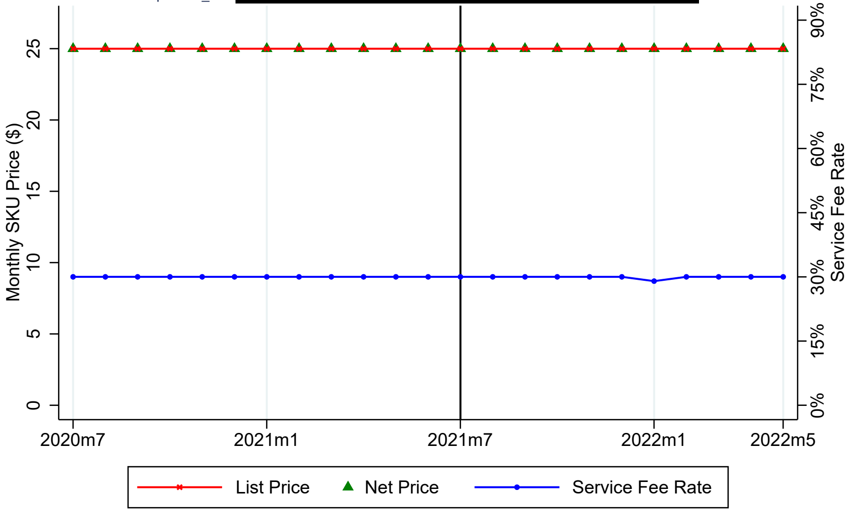
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 59.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 94% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 60.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

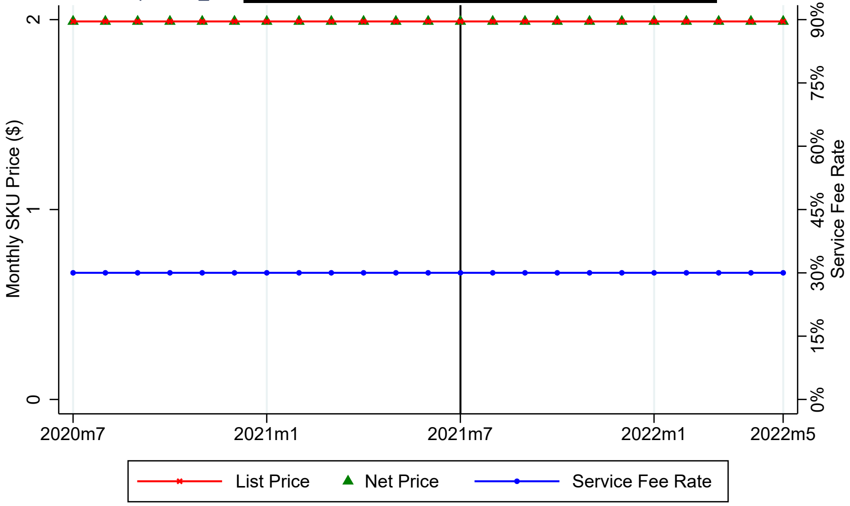
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 61.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 87% (for the corresponding app developer).

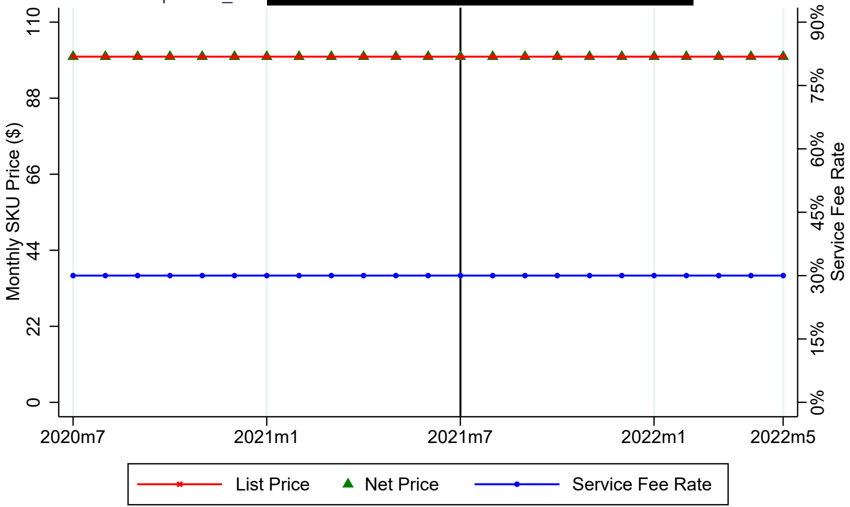
[redacted]

product_id = [redacted]



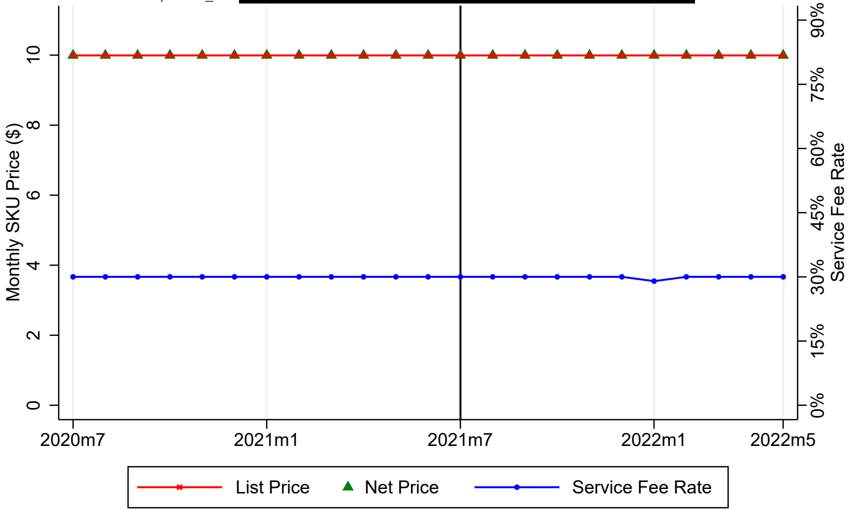
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 63.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category);
81% (for the corresponding app developer).

product_id = [redacted]



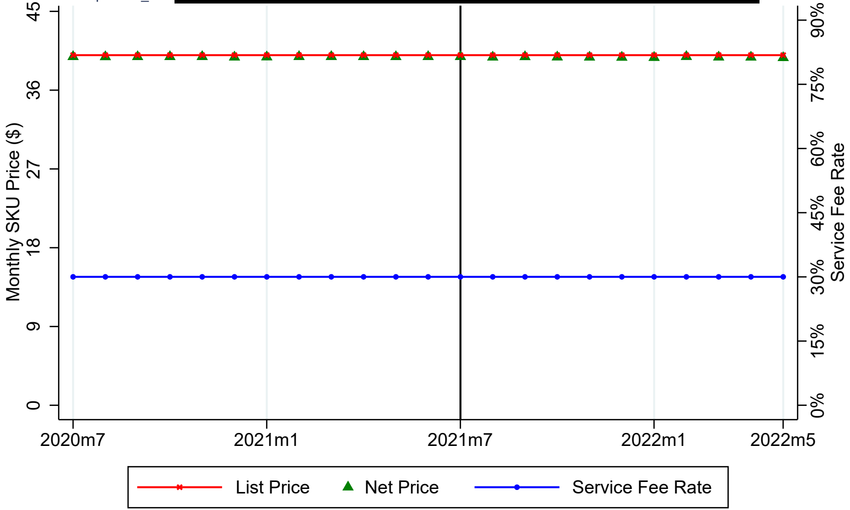
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 64.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 94% (for the corresponding app developer).

product_id = [redacted]



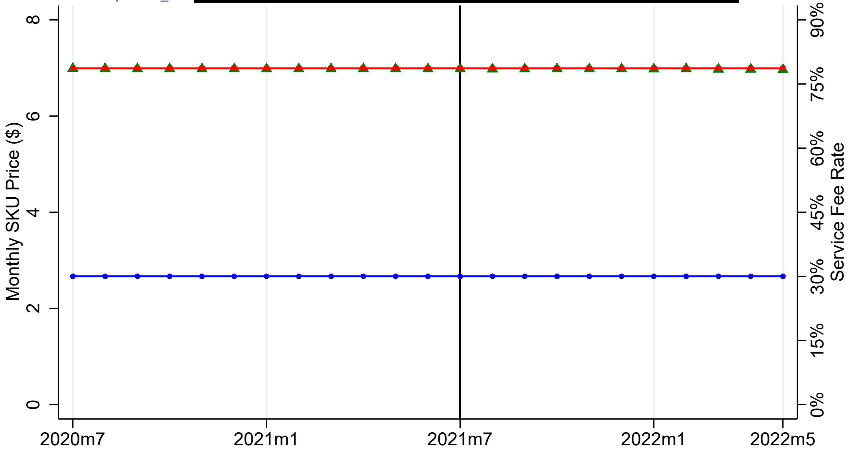
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 65.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 87% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 66.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

product_id = [redacted]

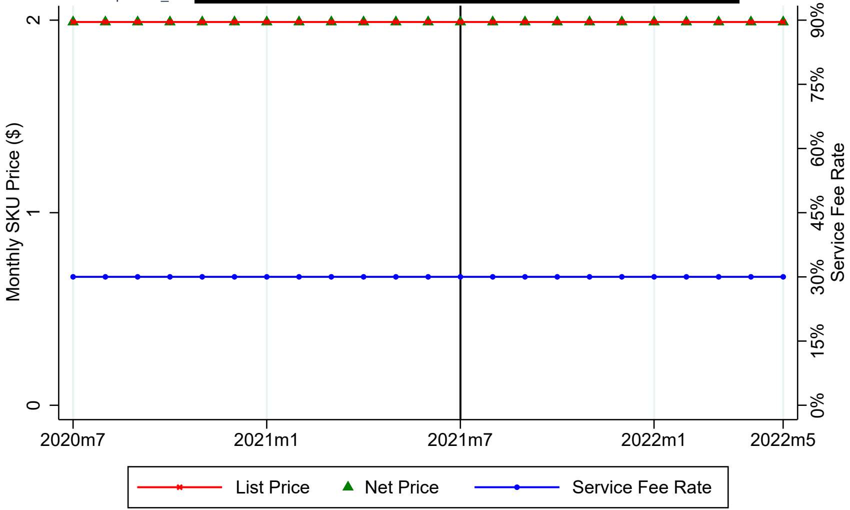


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 67.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

[redacted]

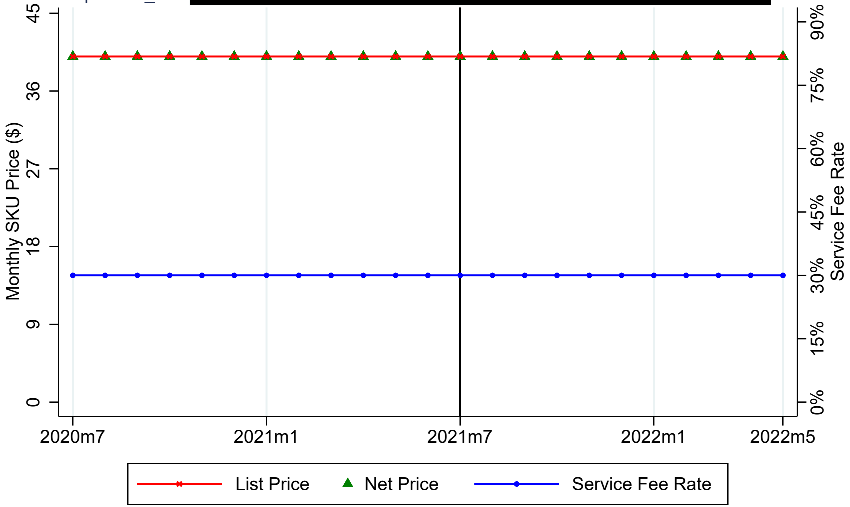
[redacted]

product_id = [redacted]



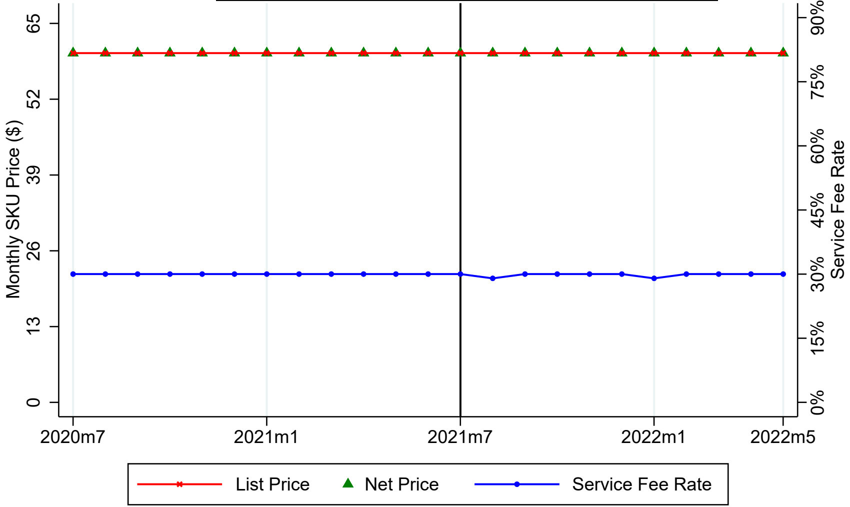
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 70.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 71.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

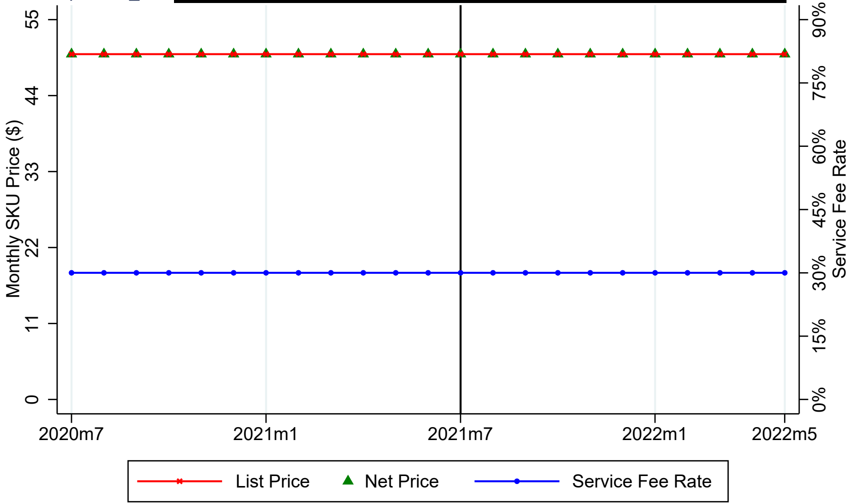
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 72.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 84% (for the corresponding app category); 74% (for the corresponding app developer).

[redacted]

product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 74.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

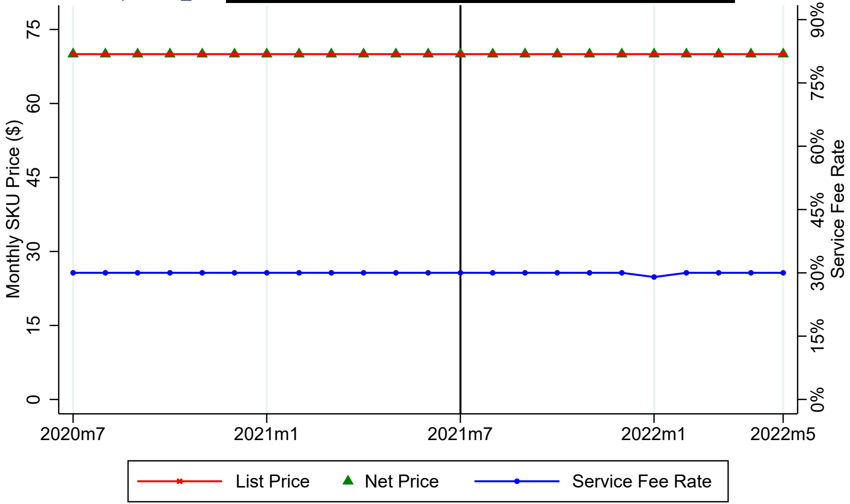
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 75.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

[redacted]

product_id = [redacted]

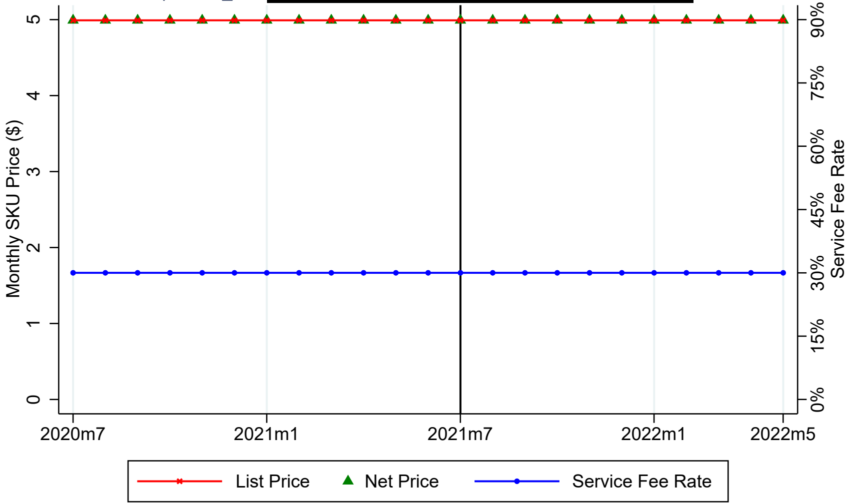
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 77.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category);
74% (for the corresponding app developer).

product_id = [redacted]

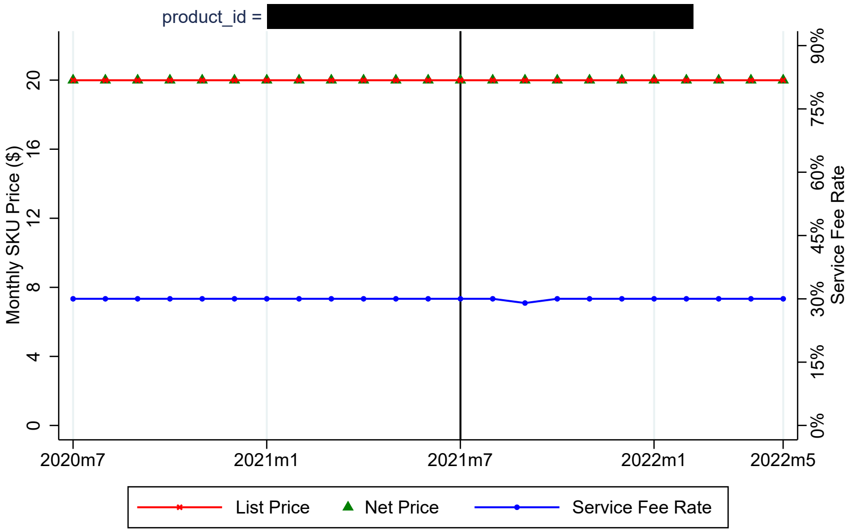


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 78.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category); 96% (for the corresponding app developer).

product_id = [redacted]

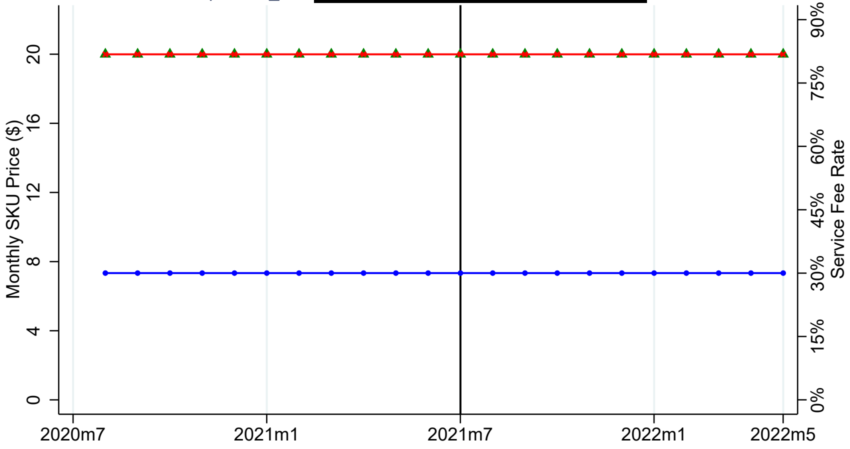


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 79.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 94% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 80.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 94% (for the corresponding app developer).

product_id = [redacted]



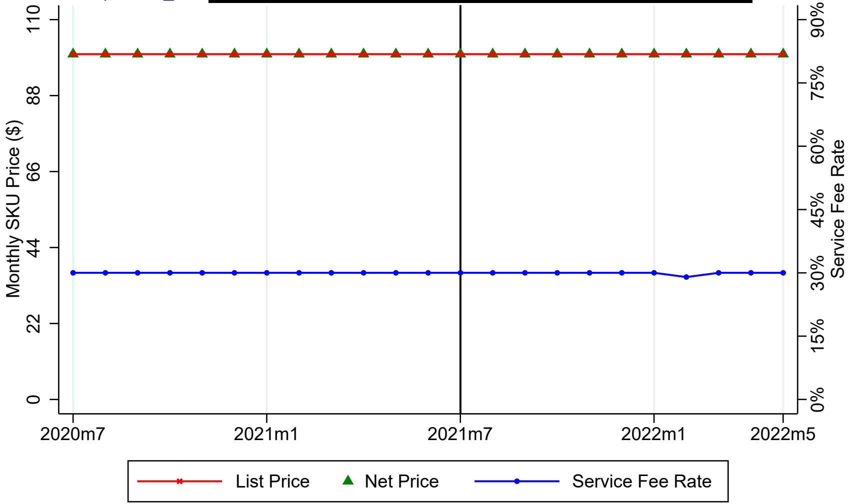
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 81.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

[redacted]

product_id = [redacted]

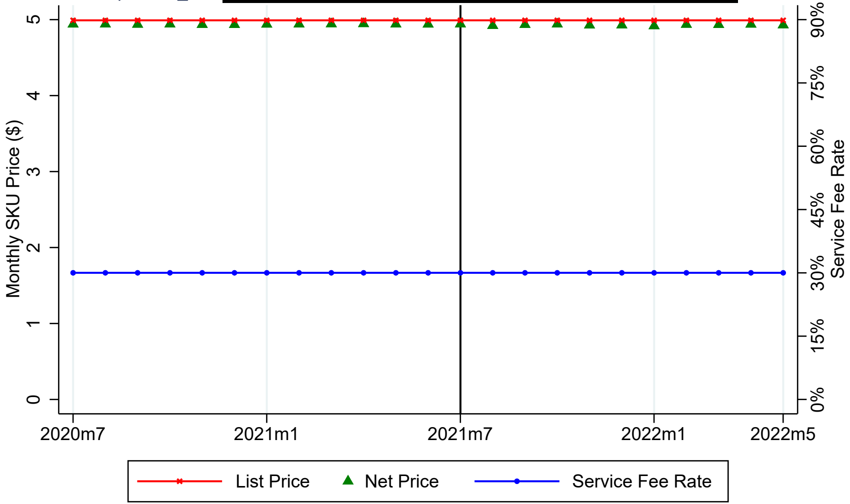
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 83.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 92% (for the corresponding app developer).

product_id = [redacted]



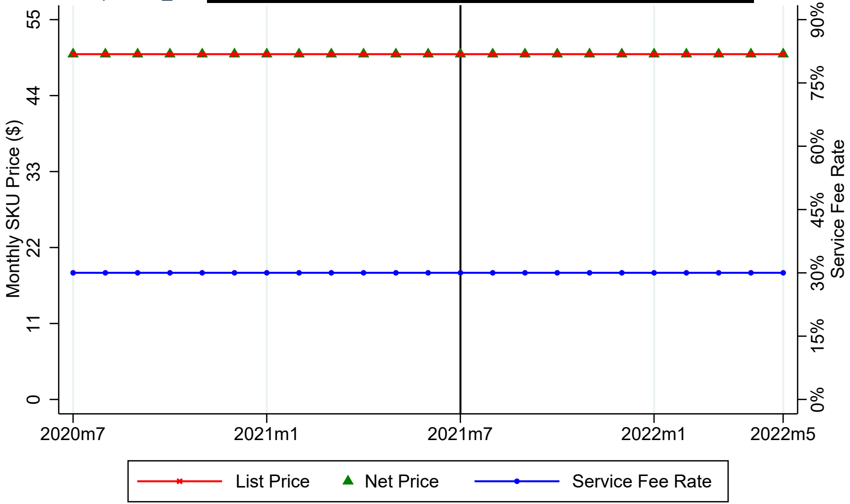
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 84.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 96% (for the corresponding app category);
95% (for the corresponding app developer).

product_id = [redacted]



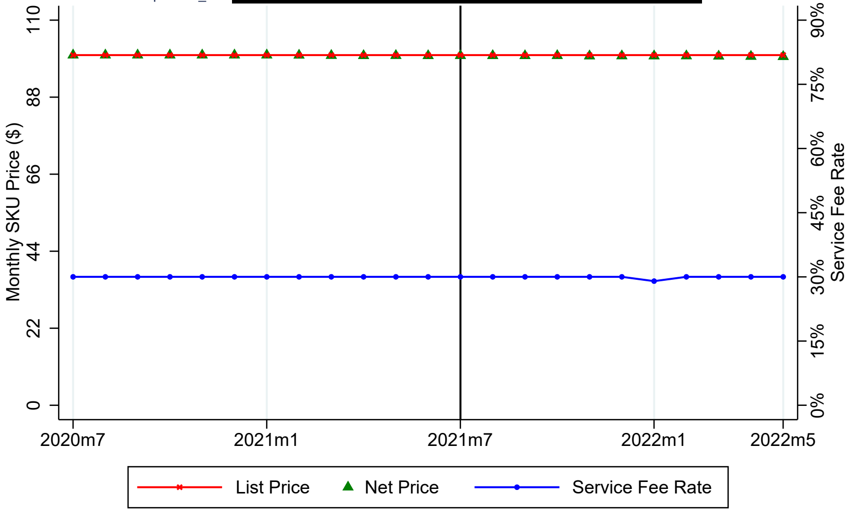
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 85.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

product_id = [redacted]



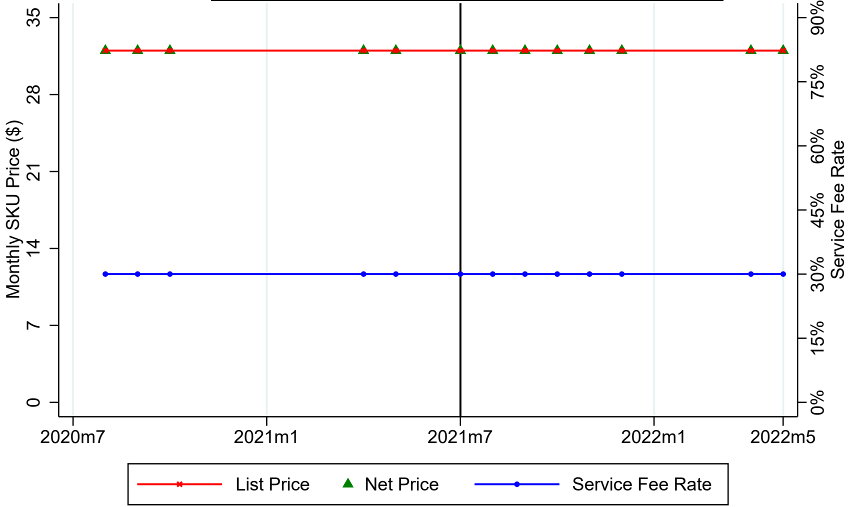
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 86.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 64% (for the corresponding app developer).

product_id = [redacted]

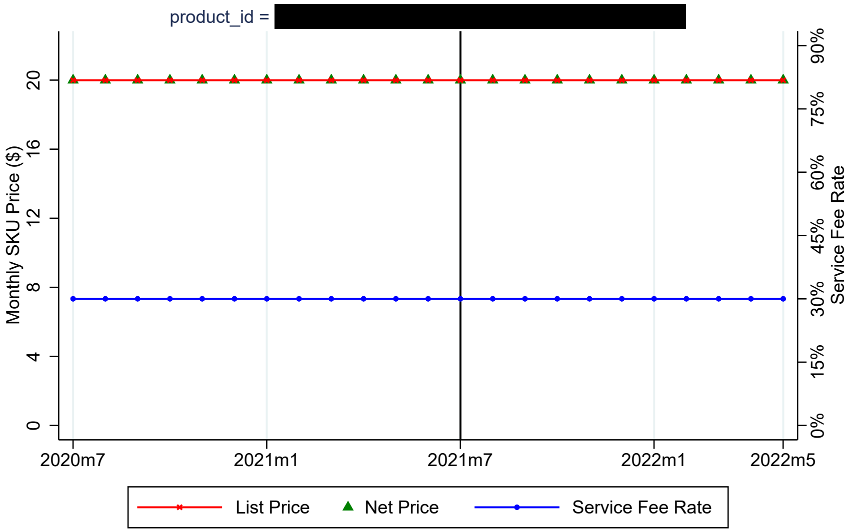


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 87.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 85% (for the corresponding app developer).

product_id = [redacted]

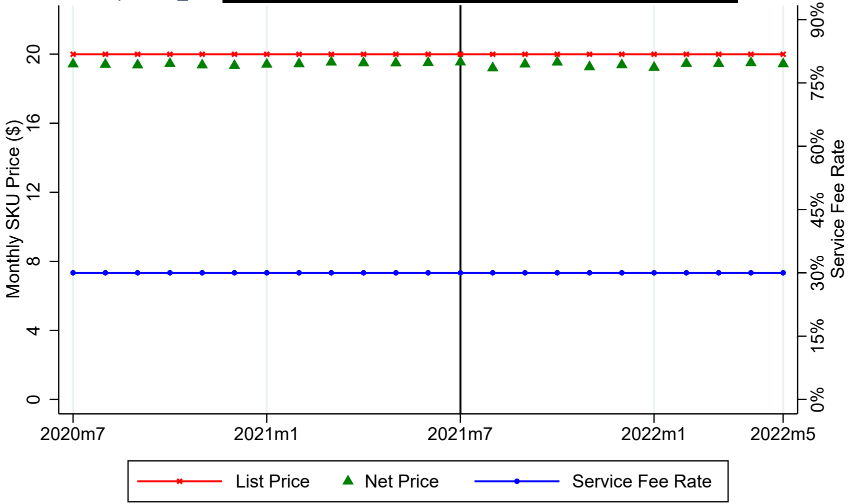


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 88.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 88% (for the corresponding app developer).



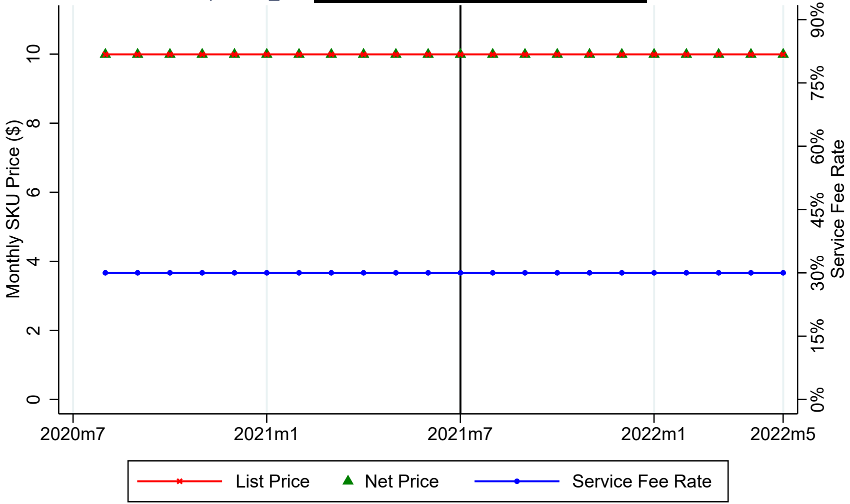
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 90.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 94% (for the corresponding app category); 89% (for the corresponding app developer).

product_id = [redacted]



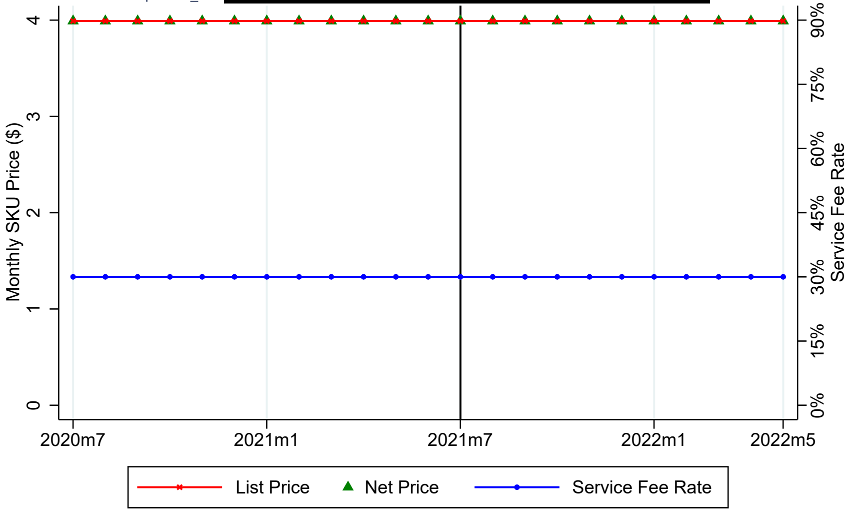
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 91.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

product_id = [redacted]



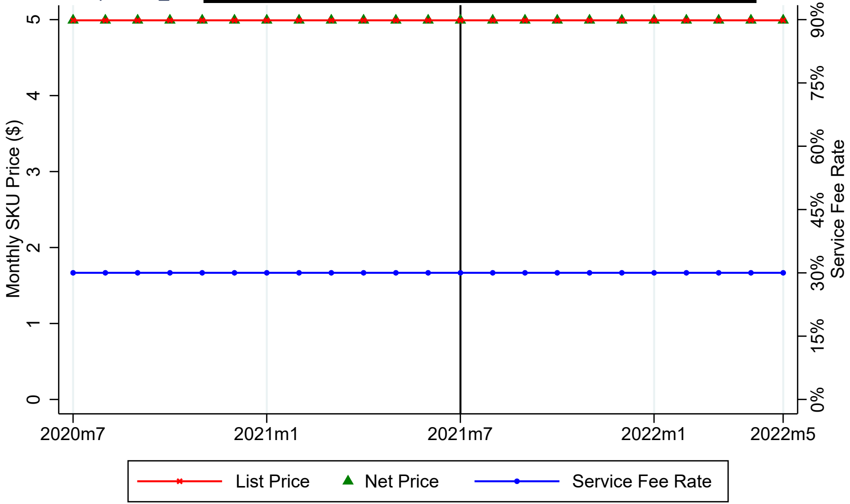
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 92.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

product_id = [redacted]



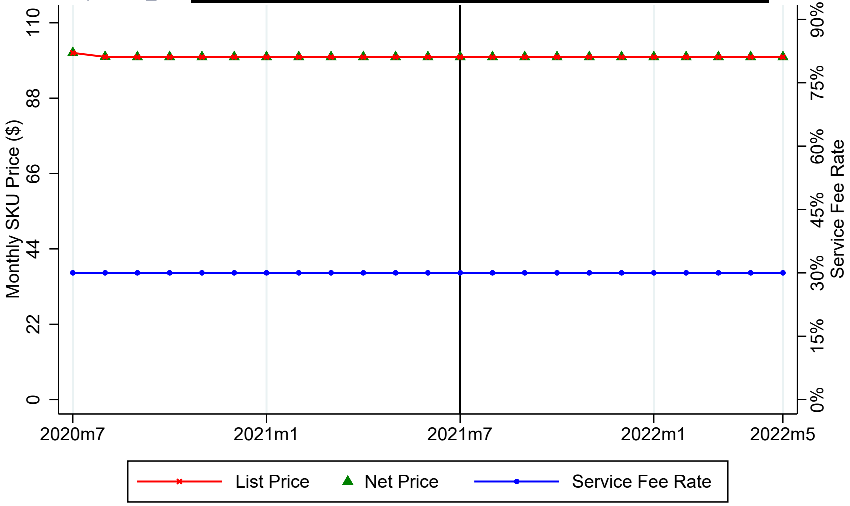
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 93.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 57% (for the corresponding app category); 39% (for the corresponding app developer).

product_id = [redacted]

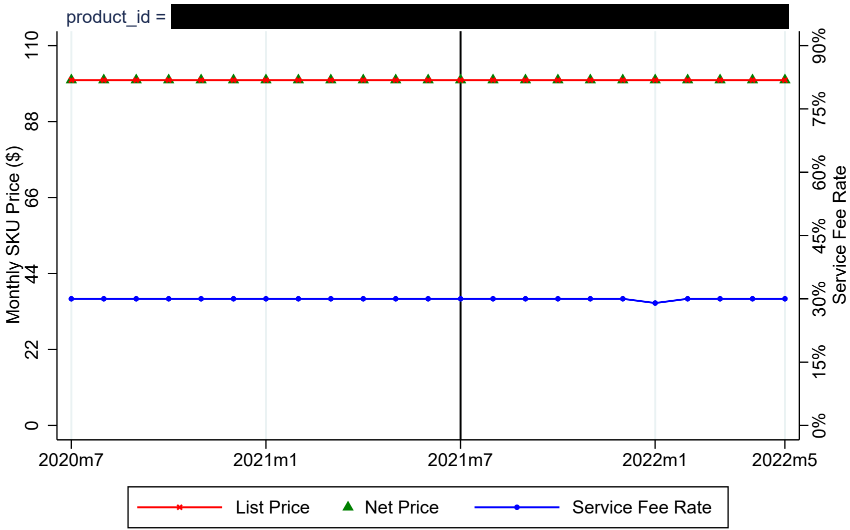


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 94.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 68% (for the corresponding app developer).

product_id = [redacted]

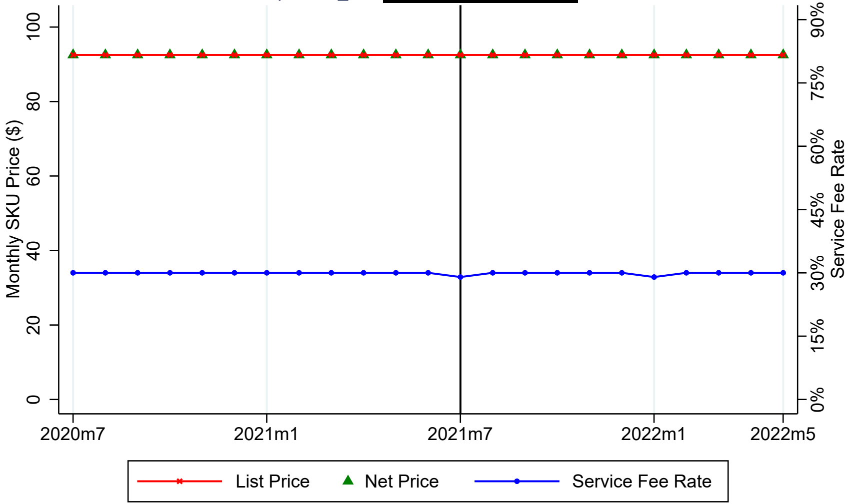


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 95.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

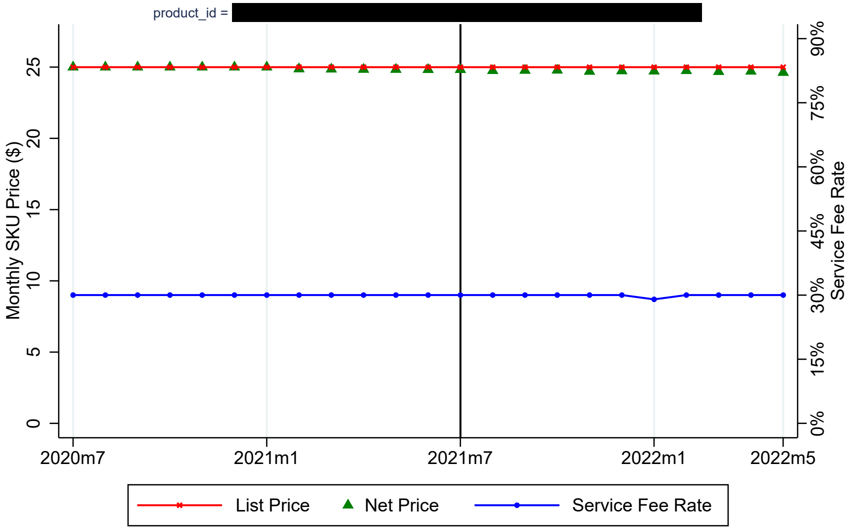


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 96.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 90% (for the corresponding app category); 93% (for the corresponding app developer).

product_id = [redacted]

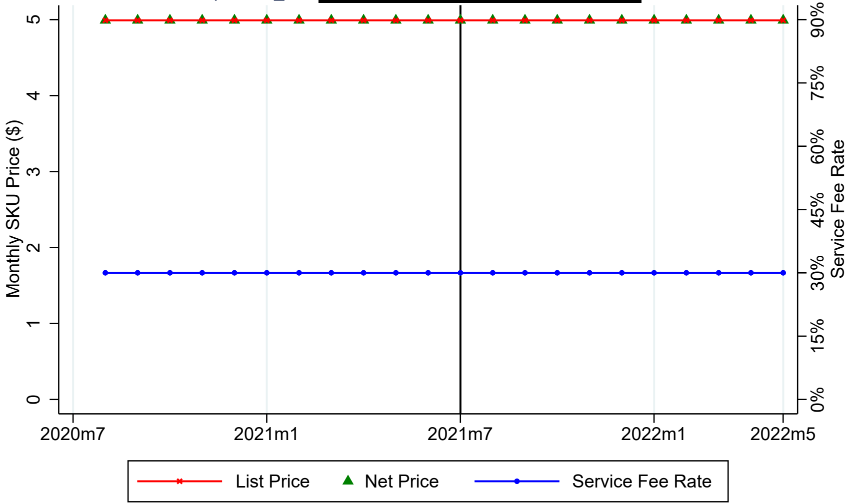


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 97.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 89% (for the corresponding app category); 84% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 98.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 85% (for the corresponding app developer).

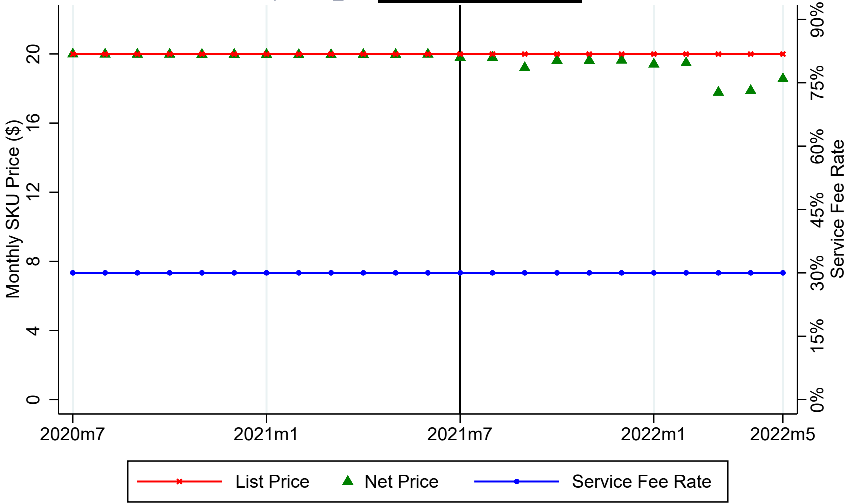
product_id = [redacted]



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 99.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 87% (for the corresponding app category); 95% (for the corresponding app developer).

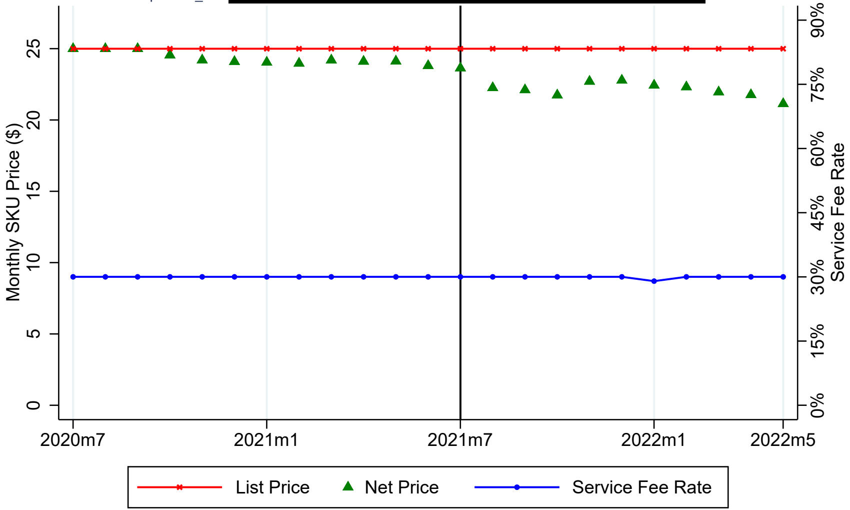
Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 100.
[2] Price change before and after July 2021: no change in the list price, no change in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 71% (for the corresponding app category); 94% (for the corresponding app developer).

product_id = [redacted]

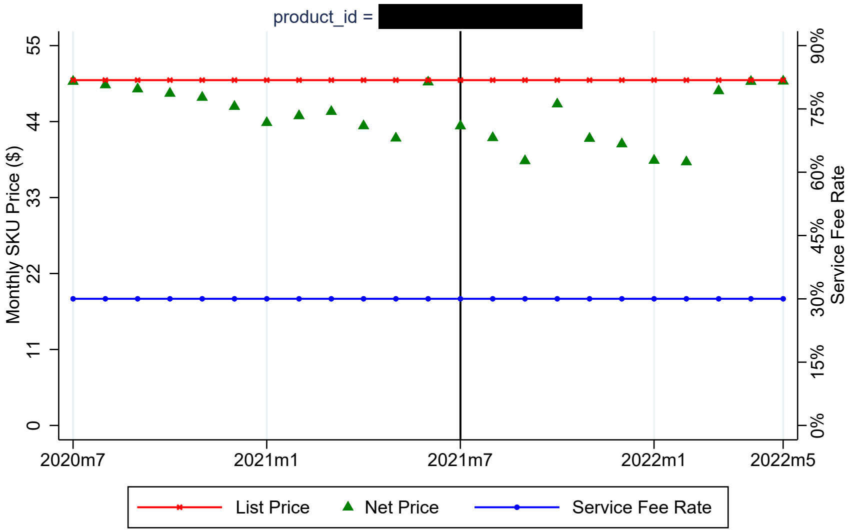


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 16.
[2] Price change before and after July 2021: no change in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 55% (for the corresponding app developer).

product_id = [redacted]

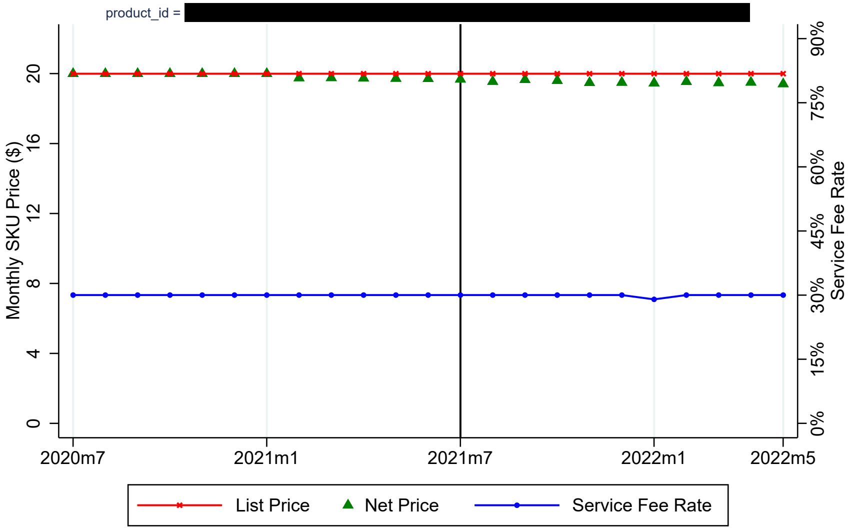


Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 20.
[2] Price change before and after July 2021: no change in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 90% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 39.
[2] Price change before and after July 2021: no change in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category);
55% (for the corresponding app developer).

Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 50.
[2] Price change before and after July 2021: no change in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 81% (for the corresponding app category); 90% (for the corresponding app developer).



Notes:
[1] Rank (based on consumer spend during 2020.07 - 2022.05) = 89.
[2] Price change before and after July 2021: no change in the list price, decrease in the net price.
[3] Pass-through rate predicted by Dr. Singer's approach: 92% (for the corresponding app category); 85% (for the corresponding app developer).

Exhibit 37a

Average Monthly Product Price and Service Fee Rate for Tinder Subscriptions

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Exhibit 37b

Average Monthly Product Price and Service Fee Rate for Tinder Subscriptions

Based on Originating Orders

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Exhibit E4
Public Redacted Version

EXHIBIT 4
FILED UNDER SEAL

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

IN RE GOOGLE PLAY STORE ANTITRUST LITIGATION	:	Case No. 3:21-md-02981-JD
This Document Relates To:	:	
State of Utah et al. v. Google LLC et al. Case No. 3:21-cv-05227-JD	:	
Match Group, LLC et al. v. Google LLC et al. Case No. 3:22-cv-02746-JD	:	
Epic Games Inc. v. Google LLC et al. Case No. 3:20-cv-05671-JD	:	
In Re Google Play Consumer Antitrust LItigation Case No. 3:20-cv-05761-JD	:	

** ATTORNEYS' EYES ONLY **
TUESDAY, APRIL 4, 2023

Video Recorded and Remote Zoom Deposition of HAL J. SINGER, Ph.D., taken pursuant to Notice, at the law offices of Munger, Tolles & Olson LLP, 601 Massachusetts Avenue NW, Washington, DC, commencing at approximately 9:11 a.m., on the above date, before Rose A. Tamburri, RPR, CM, CCR, CRR, USCRA Speed and Accuracy Champion and Notary Public.

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Bureau of New York

GLEN FORTNER, Videographer

(Via Remote Zoom)

BRANDON KRESSIN, ESQUIRE
TATE HARSHBARGER, ESQUIRE
ADAM HOEFLICH, ESQUIRE
STEPHEN MYERS
DR. KEVIN CAVES

I N D E X

TESTIMONY OF: HAL J. SINGER, Ph.D.

E X H I B I T S

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DX-1113	University of Utah Campus Directory	20
DX-1114	Logit Chapter from Kenneth Train Textbook	92
DX-1115	Apple Slide Deck - Bates Nos. DX-4526.001 - 138	253
DX-1116	Daniel L. McFadden Nobel Prize Lecture, December 8, 2000	410

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REQUEST FOR PRODUCTION OF DOCUMENTS

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None		

STIPULATIONS

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None	

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And do you get compensated in any way for the amount that Econ One bills for the staff time that was spent on this matter?

A. Yes.

Q. And how does that work?

A. So in -- in general, I keep a percentage of the billings of the -- of the staff who are beneath me, who are working in support of me, yes.

Q. And what percentage is that?

A. So, in general, it's 30 percent, but -- but with -- with the -- with the exception of the -- of the fairly senior level person, I'm keeping 20 percent.

Q. Okay.

And so just total compensation for your work in this matter, both your work personally, as well as your share of the staff's work, do you have any estimate of that?

A. I do not.

Q. Do you think it's more or less than $2 million?

A. My personal compensation? I don't think it's $2 million, no.

alternatively, the overcharge can take the form of a suppressed subsidy.

I just want to make sure -- I couldn't tell if your question allowed for that -- that second one.

Q. Understood. I appreciate that.

Let's just -- let's talk about the -- the overcharge side, setting aside the subsidy for a moment. Okay?

A. To be clear, they're both overcharges, right, but -- but I -- I think I'm -- I think I get your drift. But you'll -- how about we'll talk about take rate side.

Q. Well, you know, I'm not going to say the take rate side, but I'll -- I'll get to -- I appreciate the clarification.

MS. GIULIANELLI: This could take all day. Objection.

MR. RAPHAEL: I appreciate your clarification. I will -- I'll ask questions so I'm not confusing you. Okay?

THE WITNESS: All right. Okay.

BY MR. RAPHAEL:

Q. So if a consumer purchased an app, a subscription or an in-app purchaser from a

developer --
A. Um-hmm.
Q. -- and that developer would not have lowered its prices if it paid lower service fees, setting aside your subsidy model, that consumer was not overcharged as to that purchase?
A. Well, I think you're -- you're asking me to assume if there are no damages, then there are no damages, and I think -- which is tautological. But -- but we -- my model and my view of the world is that every developer will, particularly over the long run, reduce its prices in response to reduction in its costs. That's -- that's my hopefully very uncontroversial view; right?
So I have to respectfully dis -- reject the assumption that's baked in that -- that this developer for some reason defies economics, defies empiricism and pockets 100 percent of the take rate reduction. I think that's what you're asking me to assume.
But what I'll grant you is that if you -- if you're willing to make those uneconomic assumptions, that -- that -- that

certain developers defy economics and pocket 100 percent of the take rate, then when you go down the take rate path, you won't get to damages.

Q. Okay.

So your opinion is that all developers, if they experience a service fee reduction, will lower the price of their product to consumers?

A. I'd like to put -- give a little more granularity to the hypothetical 'cause the -- the way that you phrased it, you could have a take rate reduction for a day touching one percent of your revenues, right?

So I just want to make sure that if we can rule out, kind of, silly scenarios and talk about a sustained -- in my but-for world, we're talking about the advent of competition, you know, Circa 2009, 2010, they weren't talking about a sustained long-term reduction in take rate.

And it is my view that every developer under those circumstances, long-term touching all of their revenues, felt by everyone, then I do think economics would

this transaction to be consummated on this alternative platform, and I don't want you to go there because you -- you love me; I want to go -- I want you to go there because you're going to be better off, too, so here's a portion, right?

That -- that is the, kind of, the natural mechanism that's going to facilitate pass-through in steering -- pass-through in the but-for world, but it is not necessary.

Q. Just so we're clear, steering is not a necessary condition to pass-through in your view?

A. I think I can't say it any differently. It's not strictly necessary, but it is certainly helpful.

Q. I just want to make sure I'm clear on the Logit model.

If there were one transaction involving a dating app and 100 transactions involving all apps in the dating category, you calculate the pass-through rate by dividing one by 100 to get one percent share; right?

A. I may have missed it, but I take for each developer, I calculate its share, right,

within a given year or a given time period within the category.

Q. Right.

A. That is correct, okay, but I couldn't tell that from your -- from your hypothetical.

Q. Right.

So maybe I'll just cut through it and say it's true, under your Logit model for pass-through, that each developer's pass-through rate is the inverse of their share of their category?

A. It's one minus the share. Not quite the inverse, but one minus the share of their -- of their category, that's right.

Q. And so the only way that an app's pass-through rate would be -- would be zero is if the app had a 100 percent share of its category?

A. Correct.

Q. You calculated the service fee rate that Google supposedly would have charged without the challenged conduct with a Rochet-Triole model and a Landes-Posner model; right?

A. Among others, but yes.

had just been talking about our kids and wives.

Anyway, let's -- let's keep talking about dating apps.

MS. GIULIANELLI: Move to strike.

BY MR. RAPHAEL:

Q. Now, you have a pass-through rate for Tinder that is substantial, in the order of 65 percent?

A. I don't have it memorized, but it is what it is. It's whatever their -- their share is of the category that Tinder has selected to market itself, in which has a lot of economic meaning.

Q. So in your view, would it be wrong to assume that the pass-through rate for Tinder is zero percent?

A. Yeah, that -- when you say, "wrong," it would -- it would violate the predictions of the Logit model. I don't think that that's what Tinder's pass-through rate would be in the but-for world, it would not be zero.

Q. So if the Match plaintiffs' expert had opined that Tinder would pocket all of a reduced service fee in the but-for world, it

ATTORNEYS' EYES ONLY

would be your opinion that that would be inconsistent with economics?

MS. GIULIANELLI: Objection to the form.

THE WITNESS: Yes, totally wrong.

BY MR. RAPHAEL:

Q. Your pass-through model is based on categories of apps in the Google Play Store?

A. Correct, with one important caveat. It's not just that Google gets to select the categories or has selected the categories, but conditional on selecting the categories, the developer then selects which category they want -- they want in on and they want to market themselves on.

So I feel like you have two very important pieces of economic information there.

Q. Okay.

So Google decides which categories exist in the Play Store; right?

A. Correct.

Q. And developers then choose which category they want their app to be in; right?

A. Correct.

going to be able to name them, but I -- I -- I seem to recall a Nobel Prize maybe 15 years ago for -- for applied -- an applied microeconomist who was using Logit and other -- other types of regressions for the -- the dependent variable could only take on the value -- well, for certain restrictions on -- on the nature of the -- of the model.
Q. Now, you cite in your report a textbook by Kenneth Train.
A. Yes.
Q. Kenneth Train is an economist at the University of California, Berkeley?
A. That sounds right. I believe he -- he may have moved around, but -- but -- but I -- I can take your word for it.
Q. Is that a standard textbook on Logit or discrete choice models?
A. Yes.
Q. Can you think of a more authoritative source on Logit or discrete choice models than the Kenneth Train textbook?
A. Well, I think that any econometric textbook is going to cover Logit; it's fairly basic. So I think that any -- any well

received or widely used econometric text that covers Logit could be just as -- as valuable as -- as the Train text.

Q. Are there many situations in which the Logit model is not appropriate?

A. I don't know if I would say, "many," because we -- we see it being applied routinely by economists in the antitrust space, but there are certain assumptions that -- that -- that are implicit lurking behind Logit, just as there are assumptions lurking behind every economic model.

Q. And one of the -- oh --

A. Can I just finish? I'm sorry.

Q. Sorry. Sorry.

A. -- that you would like ideally to be satisfied. In certain cases, it's difficult to employ the tests for whether those assumptions are satisfied as -- as is the case here. But -- but I -- I'll grant you that there are certain restrictions about preferences in the Logit, but -- but there are restrictions in every -- in every economic model.

Q. And one of the restrictions on the

Logit model is known as the independence of a relevant alternative's property?
A. Yes.
Q. And the independence of a relevant alternative's property says that all products being studied in the Logit model should be substitutes in proportion to their share?
A. I think that's fair.
Q. Okay.
Now, if the indepen -- indepen -- if the -- well, let's back up.
Can we call it the independence of a relevant alternative's property IIA?
A. Sure.
Q. Okay.
And if the IIA assumption is not satisfied in the Logit model, then the Logit model can lead to unrealistic forecasts; is that right?
A. I'm not going to say so necessarily. I think that it could produce estimates that are different than the true parameters that you're hoping to estimate, but I think the word that you used was unreliable? And I felt --

Q. Well --

A. -- I felt like that was too harsh.

Q. Well, let me just ask you this:

Does your Logit model satisfy the IIA property?

A. I believe it does, yes.

Q. And if your Logit model does not satisfy IIA, would that lead you to have any concern that its forecasts are unrealistic?

A. Well, it would depend on -- on how badly these assumptions were violated. So I think that they're not. I think that the -- the groupings here were economically reasonable. These are not my groupings; these are Google's groupings that are then self-selected by the -- by the apps.

And there are tests for IIA, I think Haus -- Hausman and maybe McFadden have developed a test. It's -- it has its flaws as well. Those tests are not feasible here because we don't have consumer level data. We're -- we're just seeing the apps shares. So we'd have to drop the entire app out of the dataset, in which case you'd get the same findings, and so you'd always affirm the IIA.

Your experts, of course, didn't show that IIA wasn't satisfied through those tests either, which I think is confirmation that we can't do those tests. But I feel confident the IIA is reasonably satisfied here.

MS. GIULIANELLI: We can -- you can continue on, but at some point, let's take a break. We're -- I don't want to interrupt your --

MR. RAPHAEL: I'm happy to take a break now.

THE WITNESS: Great.

THE VIDEOGRAPHER: Going off record, the time is 10:37.

(Whereupon, a recess was taken at the above time.)

THE VIDEOGRAPHER: Going back on the record. The time is 10:47.

BY MR. RAPHAEL:

Q. Dr. Singer, is it your opinion that Google established the categories in the Play Store with the IIA property in mind?

A. That is doubtful. I think the record evidence tells us that Google established the

categories based largely on how Apple chose its categories.

Now, it's possible that just as a -- a pool player doesn't have physics in the back of their mind, that they're -- they're respecting the laws of physics. I think that's a famous Bill Friedman quote, that when Google is assembling its categories, it's doing it in a way that satisfies the IIA.

But it certainly would be astounding if -- if they had, if some marketing person had the IIA at the top of the mind when they were selecting the categories.

Q. Right.

Because to your knowledge, Google's decision with -- to establish the categories in the Google Play Store was made as a matter of marketing?

MS. GIULIANELLI: Objection to form.

THE WITNESS: I think -- I think that as I just stated, the record evidence suggests that Google was -- had an eye towards how Apple had designed its own categories, and I think that ultimately Google wants to

maximize the profits of the -- of the Play Store, and so it wants consumers to be able to find things easily and sensibly and it's -- it's profit drivenal; how about that?

BY MR. RAPHAEL:

Q. And in trying to maximize the profitability of the Play Store, Google established the categories by reference to the categories in the Apple App Store; is that right?

A. In part, yes. That Google -- that Apple made presumably intelligent choices, Apple's App Store was doing well and -- and Google figured that given that they are recruiting some of the same developers who are already on the App Store, that it would make sense to not disorient developers in the same -- in that sense.

Q. Okay.

If the IIA assumption is not satisfied, then the Logit model can lead to unrealistic forecasts.

Do you agree with that?

A. No, I think -- I think you asked me that earlier, and I think that it depends on

the degree to which it's not satisfied, right?

In any econometric model, just even ordinary lease squares, we -- we -- we make all sorts of demands on the nature of the error terms in the model, just as we do here. And there are -- there are errors, there are violations and there are other violations. And so I wouldn't -- I wouldn't condemn it based on -- on some small violation.

I think -- I think that if the categories were haphazardly assigned or done without any kind of economic logic such that consumers did not perceive, or at least some consumers did not perceive the elements to be substitutes, that -- that you could get unreliable forecasts.

Q. Okay.

So if consumers do not believe that the products being studied in the Logit model are substitutes, you can get unreliable forecasts?

MS. GIULIANELLI: Objection to the form.

THE WITNESS: I think that the better -- the better requirement, or the more

formal requirement, is that if -- if this property of substitution that is at the heart of Logit, which is this proportional substitution, that people tend to go places with higher shares, then you could get a less accurate forecast than -- than -- than you would hope.

I think that unreliable is -- is fairly strong language, so I'm reluctant to go that far.

MR. RAPHAEL: Okay.

BY MR. RAPHAEL:

Q. And what is the standard for when IIA has been violated to such a degree that you think that the -- using the Logit model would lead to forecasts that are inaccurate?

A. So here's some things I -- I would want to look for, is did the categories make economic sense, all right? Is there -- is there good economic basis to believe that both the developers and the consumers perceived those cat -- categories to define the contours of competition? And I think we have that here.

But the second thing that I'd want

to look at is how well the model fits. So the proof is in the pudding. If we get the wrong sign, for example, on the price term, or if we get an insignificant coefficient or if the R-squared of the model were low, those would all be indications that the IIA was violated and the Logit was not, at least applied in that contingency, was not a good fit.

But all of those -- all of those things are pointing in the right direction. And that's why I have confidence, so much confidence in the Logit applied here.

Q. All right.

MR. RAPHAEL: I'm going to mark this as an exhibit, which is Defendants', I think, 1114.

(Whereupon, a document was marked, for identification purposes, as Exhibit DX-1114.)

BY MR. RAPHAEL:

Q. All right.

So Defendants' Exhibit 1114 is the Logit chapter from the Kenneth Train textbook that you've cited in your report.

A. Okay.

Q. And I'd like you to go to page 48 of the document. And you'll see at the top of page 48 of the Train textbook, Professor Train writes that, "Proportionate substitution can be realistic for some situations, in which case the logit model is appropriate. In many settings, however, other patterns of substitution can be expected, and imposing proportionate substitution through the logit model can lead to unrealistic forecasts."

Do you see that?

A. I do see that. I don't know if we're talking about the Logit pass-through model here. I think this is just the Logit model in econometrics generally, and so I'm not clear what -- which forecast Train is speaking to. I don't think that he's speaking to the forecast of pass-through that I'm using.

Q. Well, Dr. Singer, you relied on this article in support of the Logit pass-through model that you used in your report, didn't you?

A. That's correct, but I'm just pointing out that Train's -- Train's usage of the word "forecast" most likely is speaking to a

different forecast than the forecast that I'm using the Logit model for -- hold on -- for pass-through.

Q. Okay.

Is it your testimony that your Logit pass-through model does not have to be consistent with general properties of Logit models?

A. I think that the IIA does have to be respected, but I think that it's a very particular application of Logit and a very particular prediction of what a firm's pass-through rate would be, and that's the forecast on which I'm relying.

Q. Do you disagree with what Professor Train wrote on page 48 of the article that you cited in support of your Logit model?

A. There's nothing in here that I would necessarily disagree with, but when he uses the word "forecast," what I'd like to do is -- is study the chapter more generally to see which particular forecast he has in mind and whether that has anything to do with the forecast that I am making.

For example, if -- if what he's

trying to predict are, say, the -- the predicted shares within a category and he thinks that those forecasts could be off, that's not the forecast that I'm making. So it's just the word "forecast" is so general that it's hard for me to -- to say that it has much relevance here.

Q. Do you agree that the Logit model can produce seriously misleading forecasts if IIA fails?

A. Seriously misleading forecasts?

Q. Um-hmm.

A. Well, so here we're trying to predict pass-through rates, and I don't think that our pass-through rate forecast is going to be seriously misleading for some minor infraction of the IIA. And in particular, you know, what's happening is that on a technical matter, we're -- we're concerned about some unobserved attribute being correlated with the error terms. But if the groupings are done in an intelligent fashion, all these error terms are going to cancel. They're going to wash out.

And so I feel like -- I feel like

goodness of fit of the Logit model, and -- and one of the ancillary or corollary assumptions that are embedded therein is the IIA. I feel like if, for a given category, we had gotten the wrong sign or an insignificant coefficient or a low R-squared, or we had designed the categories ourselves, divorced from economic reality, which we didn't, that any of those outcomes would have caused me to be less confident in the applicability of the Logit model. But every one of those indicators were pointing towards yes.

Q. My question, Dr. Singer, was when you conducted your regression, were you intending to test whether the IIA assumption was met?

A. I think I -- I don't know if my answer is any different. The intention was to test whether the Logit model did a good job explaining the data, but implicit in that is that the IIA assumption is satisfied.

Q. When you conducted your regression, was it your intent to test the IIA's assumption in particular?

A. I think that indirectly, indirectly, because IIA is at the heart of Logit, when I'm

testing for the goodness of fit for Logit, I'm implicitly testing for whether the IIA is satisfied.

Q. So you were like the pool player with physics; is that right?

A. I don't know if I was like the pool player.

Q. You weren't intending to test Logit, but the test that you conducted you now say is a test of Logit -- of the IIA assumption?

MS. GIULIANELLI: Just objection to the form.

MR. RAPHAEL: Let me -- I'll strike that and ask a different question.

BY MR. RAPHAEL:

Q. When you conducted your regression with respect to the Logit model, did you have the IIA assumption in mind?

A. Yes.

Q. Okay.

And was it your intent, in conducting that regression, to test whether the IIA assumption was met?

A. I think indirectly, that was in the back -- that was an intent. My -- my -- the

intent that was at the front of my mind was will the Logit model do a good job or a bad job at explaining substitution patterns within a given category, right? And implicit in that objective is whether the IIA was satisfied.

Q. Did you cite any published economics article in your reports to establish that it's appropriate to test the IIA assumption using the kind of regression that you did?

A. I don't think I've cited articles in my report that my test was a test of IIA. I think that I feel confident that IIA was satisfied by virtue of the fact that Google selected the categories, the developers selected in, the model fit well and then finally, I tested the model under other demand specifications.

There was quite literally nothing else that I could do and there was nothing that your expert did in rebutting it, zero.

Q. Right.

A. Nothing. Dr. Leonard did no test of the IIA.

Q. Right.

Other than the regression that you

did, there was no way for you to test whether the IIA assumption was met; is that right?

A. No, that's not right. You're not -- you're not hearing what I'm saying.

I have confidence that the IIA was satisfied because these are economically sensible categories that were designed by Google, that were selected into by the developers. And then when we go to do the actual fit, had the results come back differently, had the coefficients been the wrong sign, had they not been significantly significant, had the R-squareds been low, and then had another demand model done a better job at explaining the variation of the substitution patterns in the data, I would have abandoned Logit.

Q. Okay.

Other than your regression, was there any test you are aware of that you could have applied to determine whether the IIA assumption was met?

A. Yes, and I now feel like I'm repeating myself. There is the Hausman-McFadden test.

Q. But you couldn't apply that here, could you?

A. Let me finish. Let me just finish.

Yeah, the Hausman-McFadden test requires you to drop all consumers from the data who selected a particular choice and then re-estimate the model and -- and compare the coefficients, right?

Yes, you cannot do that here because we don't have that kind of granularity in the data.

Q. Are you aware of any source in economics that indicates that it is an appropriate and reliable way to test for the IIA assumption to do the kind of regression that you did here?

A. I don't think that that's how you'd find it in a textbook. I think that the way that an econometrician would counsel you is you have an assumption about how consumers choose within a category; right? If the model doesn't fit well, then that would tend to indicate that assumption is violated. But it starts with the -- with the goodness of fit of the model itself.

Q. Okay.

Are you aware of any source in economics that indicates that it's a reliable way to test for the IIA assumption to do the kind of regression that you did?

A. Let me hear it back. I'm sorry.

Q. Are you aware of any source in economics that indicates that doing the regression that you did is an appropriate and reliable way to test for whether the IIA assumption is met?

A. I don't know if -- if I can point you, sitting here, to an economic source for that proposition, but what -- what economics counsels is that to determine whether a model is appropriate, you need good economic foundation and you need a goodness of fit in the data.

And then finally, what I did is I tried alternative specifications. I don't think there's anything else that we can do.

Q. Okay.

Are you aware of any source in economics that goodness of fit is an appropriate way to test for the IIA

assumption?

A. No. The way that the economics will tell you is that goodness of fit will tell you if the Logit is a -- is a -- is the relevant way to describe preferences in substitution patterns here.

Now, IIA is lurking in the background of all of that.

Q. Right.

But you're not aware of any source in economics that goodness of fit is an appropriate way to test for the IIA assumption directly?

MS. GIULIANELLI: Objection to the form.

THE WITNESS: I think that if you go into the economic literature and you see the vast application of Logit in antitrust, mergers in particular, I think that for an economist or an agency, or an agency's economist to feel good about using Logit, what they care most about is whether the categories were constructed intelligently and with a good grounding in economics and in -- in record evidence.

doesn't do a good job here.

BY MR. RAPHAEL:

Q. Did you consider in your reports or are relying on any model of log linear demand?

MS. GIULIANELLI: And I'm going to object to -- to the question there to the extent that it calls for something not relied upon.

THE WITNESS: It is -- it is certainly possible, and I don't know this for certain, but it is certainly possible that when my modelers are trying out different demand specifications, that they would have tried out a log linear. But I -- sitting here, I don't know that for a fact.

BY MR. RAPHAEL:

Q. Do you have any view on whether log linear would be an appropriate model of demand for the apps and app transactions at issue in this case?

A. I don't have a view, but at the end of the day, I'm agnostic as to what's the best fit, you know. If -- if -- if -- if a -- if there's another model out there that does a better job at -- at explaining the data, then

I -- I should consider it.

Q. A log linear demand model is not subject to the IIA property; right?

A. It is not subject to IIA, but it imposes other restrictions on the error terms, right?

So there is no model that is, you know, restriction-free. Every model that you -- that you employ has certain lurking assumptions about the error terms, every model, right?

And -- and so I'll leave it at that.

Q. You agree that developers set their prices ending in 99 cents the vast majority of the time?

MS. GIULIANELLI: Objection to the form.

THE WITNESS: I don't know if it's the vast majority. I know that they often do, but we've seen every price point in the data; I've got a figure that shows every price point.

And we should also know that 99 was a restriction that was imposed by Google

would -- that would somehow not move, and it's something below a half a percent. It's de minimus.

Q. Right. So let's -- let's look at that. That's page 203 of your opening Merits report.

A. Okay.

Q. And this is Table 17.

A. Yes.

Q. So you find there that some non-zero amount of developers would not reduce their prices if they were committed to having their prices end in 9; isn't that right?

A. Correct.

Q. Do you know how many developers that -- that amounts to?

A. Sitting here, I don't, but it's -- should be easy to figure out the backup.

Q. Did you run a version of this table in your reports with the assumption that developers would want to set prices ending in 99?

A. I did not.

Q. Okay.

And do you know the percentage of

What the Miller article that is published peer reviewed that I'm using is looking at a different experiment, which is what happens when there's a systematic increase in the cost of all competitors within a market. Very different experiment.

Q. Okay.

And the Miller article you cited, does that refer to a per unit cost -- sorry, I'll ask a different question.

The Miller article that you cited for your Logit model, does that refer to an ad valorem cost in any way?

A. It refers to a perturbation in the marginal cost. And the way that Miller motivates the perturbation, which is a frustrating word, is -- is through a per unit tax.

Economists, when employing the Logit model, often try to exploit taxes as an instrument that moves a firm's costs around so as to infer what the pass-through rate would be.

Q. Right.

But my question was does -- the

Miller article does not refer to a ad valorem cost in any way?

A. I don't think that it explicitly refers, but it talks about perturbations in marginal costs and the ad valorem tax that Google imposes perturbs the firm's marginal costs.

Q. Well, changes in ad valorem costs and per unit costs perturb marginal costs in different ways; right?

A. Oh, they could, but what the derivative is going to tell you is how the optimal price change is given an infinitesimally small change in the firm's marginal cost. And the ad valorem tax is going to do that, is going to -- is going to change the marginal cost, as will a per unit tax.

Q. But you would use different math to find how a change in an ad valorem cost changes the marginal cost compared to a per unit change in cost; right?

A. No, we can -- I don't know what you mean by different costs, but we can solve to the last decimal place the degree to which

Q. Is it your opinion that your sales tax regressions show that developers have actually changed their pre-tax prices in response to changes in sales tax rates?

A. I think so, yes.

Q. Okay.

And your regression is specifically measuring whether that happened?

A. Yeah. In particular, the second specification, you know, the one I'm remembering a parameter of .7, is telling us that we see -- we see developers stepping up and taking a bit of the burden of the tax, this is called tax incidence in microeconomics, applied microeconomics, and as expected, the pain is going to be shared in some way between the consumer and the producer.

And this analysis, very traditional analysis of tax incidence, is telling us that the developers were willing, on average, to -- to bear a portion of the load.

Q. Well, you say, "on average."

Is it -- does your analysis find

that all developers reduce prices when sales tax rates changed?
A. I don't know if it can go as far as all, and that's a strong word. I think that we're looking at our central tendencies in the database.
Q. Okay.
So it's not your opinion that your sales tax regression shows that all developers reduce their prices when their sales rate tax changed?
A. I think that would be too strong of a statement. I think that their -- the data -- that the results could be consistent with the majority, the vast majority doing so, but a few not. I don't think that it can speak to all, I don't think in any regression.
Q. Well, do you know what percentage of developers changed their prices when their sales tax rate changed?
A. Sitting here, I can't tell you. I think that that's something that is solvable, but sitting here, I can't tell you what their --
Q. Did you estimate that in your

reports?
A. I don't think so.
Q. Okay.
And price stickiness didn't stop developers from changing their price when their sales tax rate changed; right?
A. Correct. It may have impeded it to some extent, but it -- it didn't fully stop it because of the coefficients that we find.
Q. And in your tax regression, the independent variable is the tax rate; right, the percentage?
A. I think that's right, but it's possible that we multiplied it by the -- the value of the -- of the app, itself. I just would have to go back in the code. But that's what's driving variation for sure on the right-hand side of the regression.
Q. You don't know whether your independent variable for the tax regression is the percentage of the sales tax or the gross amount?
A. Sitting here, I just -- that's something I can't recall, but -- but I will fully acknowledge that that's what's driving

you tried to do the derivative in your head.
I think that when you look at the traditional models of pass-through, which, remember, are a derivative of the -- if you think of it as a derivative of the Lerner index, it's -- it's looking at how the profit maximizing price changes in response to a change in cost.
And then you look at the most common functional forms. You'll often see that marginal cost drops out of the pass-through equation.
BY MR. RAPHAEL:
Q. Well, does it drop out when you're looking at an ad valorem cost?
A. In this case, it drops out of the pass-through equation, yes.
Q. Okay.
And can the amount of a developer's marginal cost, other than the service fee, affect the amount of pass-through?
A. Not under the Logit model that I'm using. It's conceivable it could in others, but in my Logit model -- not -- in the Logit

model, it's not mine, in the Logit model, it tells you what portion of every dollar in marginal cost reduction is going to be passed through to the user.

And when you think about how to calculate that reduction in marginal cost, it doesn't turn on the other marginal costs; it turns instead on the developer's price and the change in the take rate.

Q. Right.

So your Logit model that you used, the estimate of pass-through damages is not affected by any developer's marginal costs other than the service fee?

MS. GIULIANELLI: Object to the form.

THE WITNESS: I think that mechanically, you don't need to know the other marginal costs in order to implement the Logit model, but this is an important caveat. I just want to make sure that you know that that Logit model, and any other derivative of the -- of -- let's call it the first order condition or the profit maximizing price, all takes into account the cost; that is, the

costs are in the formula when you take the first derivative, right?

You start with a profit function, you take the derivative, and you get the profit maximizing price. Then you take another derivative of that profit maximizing price with respect to a change in cost. It just so happens that under the most common functional demand forms, the marginal cost falls out of the math.

So I just want to make sure the record is clear. To go implement Logit, to go implement Linear, you don't need to know the firm's other marginal costs, but that's not to say that they play no role in the pass-through calculus.

BY MR. RAPHAEL:

Q. Have you estimated in your reports any developers' marginal costs other than the service fee?

A. No, and I feel like you asked me this before. I'm confident that they have other marginal costs, but I haven't estimated at the developer level what their other marginal costs are.

The most -- I mean, the most obvious one would be processing fees. But there are other marginal costs, royalty fees that they pay, but -- but I haven't estimated those at the developer level.

Q. One of the inputs into your pass-through model is Google's market share in a world without the challenged conduct.

A. Not in the pass-through model. Did you mean to say -- it certainly -- Google's market share is in Rochet-Triole and it's in Landes-Posner.

Q. Yes. One of your inputs into calculating what Google's but-for service fee would be is Google's market share in the but-for world.

A. Correct.

Q. And you estimated that share to be 60 percent; right?

A. I -- I used as an input the 60 percent because that's the best that the economic literature in busting up monopolies can -- can give to us.

I also, you know, would note -- yes, that is -- that is the best estimate that

I could find in the literature.

Q. Okay.

And that market share estimate is based on an article that attempted to estimate AT&T's market share in the longest in its telephone market in the 1980s?

A. Yes, with one important caveat that you left out, which was after AT&T's anti-competitive tie was unwound, right?

What I -- what I was looking for was the closest analogue in antitrust history in which a dominant firm that had extended its leverage from one market into another was forced to unbundle or break apart the tie. There aren't a lot of such episodes, right, in the history of antitrust for reasons that we could describe -- discuss over coffee, but we, in any event, it's a network industry; it's the monopoly, where the tie gets removed. It's been studied ad nauseam by economists for -- for the price effects that can be attributable. And so I thought that 60 percent was the best estimate.

And in any event, it turns out my -- my in-app model for damages is not that

sensitive to the 60; that is, as you put in different inputs for 60, you go to 70 or if you think that Google share would have fallen to 50, it just turns out that the model is not that sensitive to that input.

Q. Well, do you disagree that if Google's but-for market share is 75 percent, that your damages figure falls by over 40 percent?

A. No, it wouldn't. It would not.

So you're saying if all you did -- see, what -- what Dr. Leonard, respectfully, did was that he kept changing two parameters at a time. He kept changing the but-for share and the actual share. If he held everything constant for Landes-Posner, if you change just the but-for share, say, by 10 percentage points, you get, depending on which direction you go, you get something on the order of a 5 percentage point swing in damages.

And so what -- what that's telling you is that the input is important, but the results don't vary significantly, or let's just say the results aren't amplified based on the change in this input; that they're, in

being sued for -- for similar allegations of the challenged conduct that's here.

Q. Are you offering an opinion in this case that Apple is engaged in any anti-competitive conduct?

A. I -- I have not offered that opinion, but I can rule out putting Apple in the benchmark when it is the subject of -- of antitrust scrutiny for having engaged in many similar strategies here and charging, you know, what I believe to be a super-competitive take rate in perpetuity on ancillary transactions.

Q. Let's talk about your Play Points model for a minute.

A. Okay.

Q. Just so we're clear, users have to opt in to Play Points?

A. Yes.

Q. And in the actual world, less than [redacted] of Play Store users actually opted in to Play Points; right?

A. Right. Google is so skimpy with its subsidy today that it blunts the incentives of consumers to -- to opt in. There are costs to

opting in and participating in a loyalty program, and if the benefits for doing so are paltry, that could affect how many people take advantage of the program.

Q. Right.

There are costs to opting into a rewards program; right?

A. Yes.

Q. Okay.

And in the -- in your Play Points damages model, you assume that all Play Store users would have signed up for the Play Points program?

A. No.

Q. You don't?

A. No, not necessarily. What I'm trying to solve for is the extent of a subsidy that Google would have offered across -- in the aggregate across all users, but I don't think that I'm necessarily assuming that each user avails itself. It's possible that it would, but my -- my damages model for aggregate damages is looking at the savings to the class if Google were to be more generous in its subsidy program.

Q. Your Play Points model measures the damages that consumers would have incurred in the aggregate?

MS. GIULIANELLI: Objection to the form.

THE WITNESS: I think that my model is being offered for an estimate of aggregate damages, among other things; I think it also speaks to injury and impact. But I -- I -- I believe that that -- that -- that parameter that comes out that we're interested in, which is the price on the consumer side of the market, is telling you across all consumers, this is -- this is what -- what -- what Google will pay.

BY MR. RAPHAEL:

Q. Does your Play Points model tell the jury how much a user who did not sign up for Play Points in the actual world was damaged?

A. You could estimate, for a given member of the class, you could estimate what the reduction in -- in his or her net payments would be relative to what they spent in the actual world. And you wouldn't abandon that exercise simply because they didn't use Play

Points in the real world. In the real world, the reason why most people or many people didn't use it is because Google was so skimpy with the offering.

In a but-for world in which Google is forced through competition to employ a more generous points model, including making the enrollment easier, they'd -- they'd be forced to. Under -- in a competitive market, it would be reasonable to assume that -- that most, if not all, consumers in the class would -- would partake and -- and take advantage of that -- of that program.

Q. Are you offering the opinion that all users in the but-for world would have signed up for the Google Play Points program?

A. Economists tend to be reluctant to say all, like do I know with certainty or to a reasonable certainty that every single class member signs up? I don't know if the model can tell us that.

What the model is telling us is what's the -- what is the aggregate or average subsidy that Google offers. And I think that it is reasonable to infer that if the subsidy

gets sufficiently large such that it is a meaningful reward, that most, if not all, consumers will take advantage of it in the but-for world.

Q. Have you estimated what portion of users would have signed up for the Play Points program in the but-for world?

A. I feel like that question is no different from the -- from the last.

I have not given an empirical estimate of the proportion. I think it's very high, it could be close to 100 percent, but there's no requirement that it's a hundred percent for the model to -- to hold.

Q. If I were to come to you with a user chosen at random from the data that you've looked at of people that used the Google Play Store, could your model tell me whether that user would have signed up for the Google Play Points program in the but-for world?

A. I don't think the model tells you whether a user will sign, but what the model can tell you is what the subsidy, what the predicted subsidy would be for that user. And if the subsidy is as large as these models are

implying, whether it's the Rochet-Triole model or the Amazon model, these are big numbers; we're talking about [redacted] to [redacted] percent savings.

It seems like a safe inference is that if a -- if Google wants to credit you between [redacted] and [redacted] percent, I'm going by memory, of the -- of the price of partaking in all the fun of its Play Store, that most, if not all, consumers will avail themselves of that option.

Q. Have you calculated the minimum value of the Play Points subsidy that would be necessary to get any consumer to sign up for Play Points?

A. I haven't calculated it down to the decimal, but my opinion is this; that in the actual world, with a -- with a paltry subsidy of [redacted], you see many people not availing themselves of the option.

In a but-for world where the subsidy is in the order of [redacted] to [redacted] percent, if we -- if Google matches Amazon, I think a safe inference is that all or almost all consumers will avail themselves of that option.

Q. Well, your Play Points model, though, is about the percentage of the price that would be credited back to consumers, not the percentage of Google's revenue; right?

A. Oh, no, no, no. Hold on. We're on the same page, I think. It's the percentage of the price from the consumer's perspective; right?

Q. Right.

A. And so if -- if in a but-for world, Google takes its subsidy from, say, [redacted] percent to [redacted] percent, right, that is a material change in the terms of the program, at which point you're looking at all your friends who are getting [redacted] percent off and you say hey, sign me up, I'll take some of that, too.

Q. Right.

Have you calculated the percentage credit on the price that would be necessary for any consumer to find it worth it to overcome the cost of signing up and sign up for the Play Points program?

A. I haven't calculated the percentage, but I will say that in a but-for world where

Google is going head-to-head with a -- with a competitor who is competing on this dimension, whether it's Amazon or Facebook or Samsung, that Google would make sure that whatever enrollment costs there were, they would not be so prohibitive as to allow that rival to eat their lunch.

Q. Have you done any analysis of the elasticity of demand for the Play Points program?

A. I have done elasticity of demand of consumers with respect to pricing in the App Store. So to the extent that Play Points or any subsidy changes pricing, you could figure out what the sensitivity would be.

Q. But you haven't tested whether what happens when Google changes its Play Points subsidy and how that affects whether people sign up for the Play Store -- for the Play Points program; you haven't done that?

A. Well, it's a bit of a trick question here, because Google has been at -- at this paltry [redacted] percent, you know, since the advent at least in the U.S.

Now, there are some experiments

that you might be able to look at. In Korea and Japan, I think that Google tried to meet the limited competition that -- that occurred there with an increase in the subsidy. But I haven't studied -- I haven't studied what the reaction would be.

I think it's safe to infer that Google felt, and this is just kind of basic economics, that Google felt compelled to meet the competition because they feared that if they didn't -- if they weren't competitive on that dimension, they would lose customers.

Q. Your Play Points model also uses the elasticity of demand from an article about AT&T long distance in the 1980s?

A. That's of the rival elasticity, that's right.

Q. Right.

And that's drawn from the same article as the article where you got the but-for share for Google; right?

A. Correct.

Q. And you didn't calculate the elasticity of demand in the but-for world yourself?

A. Well, this is -- remember what we're talking about is the rival supply elasticity. So Google by the tie doesn't allow any rival to enter and expand, and now you're asking me where's your -- where's your model, Singer, for how PayPal or Stripe, you know, would have responded to an increase in Google's price. They couldn't come in by virtue of the tie.

So I don't think that -- that life, by virtue of Google's restrictions and the challenged conduct here, is going to allow us to test for rival supply elasticity particularly in the but-for world.

Q. You didn't present your Amazon Coin damages model at the class certification stage?

A. That's correct.

Q. Why not?

A. I don't think that I had data at that -- at that time to estimate Amazon's subsidy.

Q. And your Amazon Coins damages model is used for calculating aggregate damages?

MS. GIULIANELLI: Objection to the form.

THE WITNESS: Correct. That -- that's fair, among other things. But I think that the primary purpose here, now that we're at the merits, is what the -- what aggregate damages are.

BY MR. RAPHAEL:

Q. And if I -- again, if I took a user at random from the -- from the data on the users of the Google Play Store, could your Amazon Coins model tell me whether -- how much in subsidy that consumer would have received?

A. Yes.

Q. And could it tell -- and -- and is your idea that the subsidies in your Amazon Coins model would have been part of a program that all users would have signed up for?

A. I think that once you get into the 19.2 percent range, I think that it would be irrational and illogical for a consumer to pass up that savings. They would figure out a way to get enrolled.

Q. Okay.

But you -- again, you haven't studied, with respect to your Amazon Coins model, the percentage of savings that would be

necessary to get all users of the Google Play Store to sign up?

A. The model isn't going to tell us that, but I think basic economics would dictate that if the subsidy got that large, all or almost all consumers would avail themselves of the program.

Q. Have you studied whether there's any consumer who just finds the idea of being enrolled in a loyalty program so cumbersome and annoying that there's no amount of reward that they would take to actually sign up?

A. I don't think that that can -- can happen in the but-for world because I think that two things, is that the subsidy, once it gets [redacted], I mean, that's -- that becomes a real savings to the consumer; and number two, Google can't throw up so many frictions in its but-for loyalty program that it -- it tends to impede the usage of the program.

That -- if people thought that -- that it was difficult to enroll and Amazon was up and running or Facebook was up and running with its loyalty program and it made it

easier, I think there would be a giant, you know, sucking sound as people switched over.
Q. Okay.
And again, if a user did not sign up for Google's subsidy program that you're positing in your Amazon Coins model, would that consumer have been any better off in the but-for world under your Amazon Coins model?
A. I think so, because even if you don't avail yourself of the option, so long as credits are accumulating, that -- that a consumer could perceive that as --
Q. Sorry.
A. -- as a savings.
Q. Let me clarify my question.
If a user did not sign up for the subsidy program and therefore was not eligible to earn any subsidies in your hypothetical for your Amazon Coins model, would that consumer be any better off in the world that you've posited?
MS. GIULIANELLI: And just objection to the form.
THE WITNESS: Yeah, what -- what you're doing is you're -- you're assuming that

there's a sign-up process in the but-for world, right. So I just use Starbucks points this morning, which is where I start, and I usually go -- I go to a different place in the afternoon, but I start at Starbucks. And -- and I don't remember having to enroll in the Starbucks program. I mean, it just was -- just when I got the app on my phone, I was enrolled in the Starbucks app.

So you're -- you're -- you're creating this assumption that Google is going to create some frictions, and they might do that now because they don't have competition. But in a but-for world in which a rival is attacking them with a 19 percent subsidy and easy enrollment, then it would be in Google's best interest to also use easy enrollment; in fact, maybe even auto enrollment.

BY MR. RAPHAEL:

Q. Okay.

Are there loyalty programs that don't use auto enroll?

A. I'm thinking about all the ones that I'm enrolled in and I -- you know, I can't -- I don't even have -- it seems to me that when

you join an airline, you're auto enrolled, credit cards, auto enrolled. I don't -- I don't remember filling out an application to enroll in almost any loyalty program.

Q. You ever go to a drugstore or a grocery store and they ask you if you want to sign up for the rewards card?

A. Yes. CVS asked me, that's -- that's true.

Q. Right.

And so does your Play Points model and Amazon Coins model assume that Google will automatically enroll all users in a subsidy program?

A. It doesn't assume auto enrollment, but -- but it does, I think, presume that if competition is occurring on that dimension, Google is going to make the enrollment costs seamless and trivial or -- or nonexistent, in which case they would use auto enrollment.

MS. GIULIANELLI: Happy to have you continue, but at some point, let's take a break just because I think --

MR. RAPHAEL: Sure.

MS. GIULIANELLI: -- it's getting

to be lunch, close to lunch.

MR. RAPHAEL: Yeah. No problem.

I'm getting close to finishing this topic, so maybe we just do that and we'll be done and take a break.

BY MR. RAPHAEL:

Q. Your Play Points model assumes that the Play Store would have a durable incumbency advantage in the but-for world?

A. The Play Points model does, as do many of my models, credit an incumbency advantage, and -- and therefore, yeah, offers what I think is a conservative estimate of damages.

Q. Why have you not made the same assumption in your Amazon Coins model?

A. The Amazon Coins model presumes that Google fully matches Amazon's offer. And I think that's reasonable for -- for several reasons. One is that I think that Amazon would pose a sufficient threat that Google would have to take it seriously when they actually -- actually consider having to go all the way down.

And number two, I feel like the

types of services that we're -- that we're talking about here could reasonably be understood as being homogenous, in which case we do get -- economics would predict prices that are the same between the incumbent and the rivals.

So just long way of answering, I've got one set of models that allows for an incumbency advantage, in which case Google is able to command a price premium vis-a-vis its attackers, and I've got the Amazon model that presumes that Google would not be able to command a premium.

And I think that -- I think that they're both reasonable, but I think that those are the bounds around which the possible damages could be.

Q. Well, your Amazon Coins model estimates [redacted] more in damages than the Play Points model; right?

A. Well, I don't know if it's [redacted] but I -- I will grant you that it is an increase in the -- in the -- in the subsidy from, and I'm going by memory, maybe [redacted] percent under Play Points up to [redacted] percent.

So that's what's doing the work.

The base of transactions are no different in the two models. So [redacted] sounds like a lot, but we're actually just toggling between say [redacted] percent subsidy to a [redacted] percent subsidy --

Q. Well --

A. -- which I don't think is that -- that large of a range.

Q. As between the Play Points model and the Amazon Coins model, which do you think is a more reliable model of the but-for world?

A. I don't -- I don't know if I have an opinion as to which one is more reliable. I think they're both reliable. I think that I've set the bounds now on -- on -- on what damages could be. And one is certainly more conservative, which is the one that -- that allows Google to preserve a -- an incumbency advantage.

So I think that it's -- I think that it's fine to offer the two and -- but I -- but I feel it's a bit unfair to say -- it's like asking me to choose between my daughters. You know, these are two good

models and I think they're both reasonable.

Q. So you can't say whether it's more reliable for the -- to estimate damages at the [redacted] that you have for the Amazon Coins model or the three plus billion that you have for the Play Points model?

A. No. And you keep -- you keep going back to the difference in the magnitude. That's just because we have such a large base of spending.

What we're really trying to figure out is as we toggle between the [redacted] percent of the Play Points and [redacted] percent, which is about [redacted] percentage points, should we -- should we credit Google with an incumbency advantage or should we not.

I think there are legitimate arguments that would suggest that if entry by a rival were to occur early enough in the place for experience, then it would be -- it would be too charitable to Google to credit it with an incumbency advantage, right? If Google were facing a rival right out of the gate, right, what's the source of its -- of its incumbency advantage?

Q. Have you formed an opinion as to which of the numerous different damages models that you have is the most reliable one for the jury in this case?

A. I think it's -- it's hard to compare models that are meant to do different things, right? We've got some models that are meant to -- to come up with but-for take rates and pass-through in the -- in the primary market. We've got a different model that's meant to predict the but-for take rate in the aftermarket.

I don't know how one would say that one is better than the other. I feel like these are the best that economics has to offer for each of the -- each of the problems that I've been given.

Q. Did you consider using any other App Store as a benchmark for your subsidy model rather than the Amazon App Store?

A. It's -- it's certainly possible I considered. One -- one problem that I had, for example, with the ONE Store is that the ONE Store is competing along both dimensions. I think they took their take rate down and

they did a more generous subsidy program. And remember, in this -- when we go down this branch of the tree, we're thinking about competition that only occurs on one dimension; namely, take rate.

And the second thing that -- that worried me about ONE Store is that it's -- it's specific to Korea and Amazon was -- was global. And so I felt that -- that we just didn't have as good of a benchmark as Amazon for -- for that parameter.

Q. Okay.

A. Oh, there's one more reason, too, is that I don't think we have the magnitude of ONE Store's subsidy. We have the dollar amount, I found press articles that said it's X hundreds of millions of dollars, but I -- I -- I wasn't able to -- to generate a -- a subsidy in terms of percent of spend for ONE Store.

Q. Okay.

MS. GIULIANELLI: Pretty soon we can take a break for lunch.

MR. RAPHAEL: Sure.

BY MR. RAPHAEL:

Q. Did you -- did you analyze whether any of the benchmark App Stores in Table 7 offer subsidies and whether you could use those as benchmarks?
A. I did not.
Q. Okay.
Just a couple more questions and we can take a break for lunch.
A. Okay.
Q. Now, users sign up for Play Points and then they earn points when they make purchases; right?
A. Correct.
Q. And Amazon Coins have to be purchased separately?
A. Correct.
Q. Did you consider whether that difference could affect whether the Amazon Coins program is a proper benchmark?
A. I certainly considered it, and I just want to make clear that in my -- in my but-for world under this model, I am not positing that Google mimics Amazon's program verbatim, right. I recognize there are differences in the program.

What -- what I'm interested in in looking at the Amazon experiment is the size of the subsidy. These are -- these are monies that were actually redeemed by Amazon's consumers and that's the -- that's the input that my model is calling for.

Q. Did you consider whether any differences between the Amazon Coins program and the Play Points program could affect how much Amazon offered as a subsidy?

A. I mean, I studied the differences in the program, but I can't -- I can't think of a good reason sitting here, maybe you can give me one, for why that difference in the program would cause the subsidy to vary. I just -- I can't think of one.

Q. Well, when users buy Amazon Coins separately and they can't be converted back to cash; right?

MS. GIULIANELLI: I'm sorry, did you say can or can't? I just...

BY MR. RAPHAEL:

Q. When users buy Amazon Coins separately, they can't convert those Amazon Coins back to cash; right?

A. I think that's right.
Q. And so could the fact that once consumers have purchased Amazon Coins, they're stuck with them, lead Amazon to try to offer significant discounts to get people to buy Amazon Coins?
A. I don't think so.
Q. Have you analyzed that issue at all?
A. No, but that -- it just doesn't sound reasonable as an economic matter.
Q. All right. Last line here.
You looked -- in your Amazon Coins model, you looked at the share of consumer discounts for purchases on Amazon's App Store as a third-party App Store, not on Amazon devices; right?
A. Correct.
Q. And why did you do that?
A. Because I -- I felt that the best competitive benchmark would be how an independent App Store would price on someone else's platform.
Q. And you made that decision even though you would agree that the vast majority of Amazon's revenue from the App Store and

discounts were on purchases on Amazon devices?
A. I don't know if it's the vast majority. I do know that Amazon is at a hard time because of challenged conduct here from getting on to Android phones, but I haven't done a decomposition of the -- of where it's -- where its App Store revenues are coming from.
MR. RAPHAEL: Okay. Why don't we take a break now.
THE VIDEOGRAPHER: Going off the record. The time is 12:26.
(Whereupon, a luncheon recess was taken at the above time.)
THE VIDEOGRAPHER: Going back on the record. The time is 13:03.
BY MR. RAPHAEL:
Q. All right.
Dr. Singer, let's go back to your regression that you ran in connection with your Logit model.
That regression finds a correlation between the price that a developer charges and the share of that developers' app category?

A. Close. It's just -- yeah, the share of that developer within its category, that's right, its market share.
Q. Right.
And so what the regression is looking at is if the developer changes its price, does that reduce its share of the app category; right?
A. Right. Implying that -- that there would be substitution away from that app towards what consumers perceive to be substitutes.
Q. Right.
And does the regression that you ran that looks at the change in price and its effect on the developer's share of its category tell you anything about where the substitution, as you put it, comes from?
A. Where it comes from is, of course, the app who is raising the price. Did you mean to say where it's going? I don't -- where it's coming from --
Q. Ah, thank you for that.
A. Okay.
Q. I'll ask a better question.

A. Okay.
Q. So your regression that you ran in connection with your Logit model, does it tell you where, when a developer raises its price, where consumers will substitute to within the category?
A. This -- this particular model, or at least for this purpose of a model, or this stage of the model, it is simply telling you that the developer loses share. But once you know that the model fits and is the best demand system for the data, you can infer that users are moving around the category in proportion to the market share of the -- of the other goods.
Q. Okay.
But the regression is one of the things you used to determine the fit of the model; right?
A. Correct.
Q. Okay.
And the regression, itself, does not tell you when a developer raises its price or lowers its price, I guess, to which apps do the other -- do the consumers substitute;

right? It doesn't tell you that?
A. Correct.
Q. Do you agree that the relevant product market should include all competitive constraints?
A. No.
Q. Is product quality --
A. Can I -- also, can I just say why? I mean I --
Q. Sure.
A. Just to be clear, you don't need to include all competitive constraints because there could be some very weak constraints that don't prevent the exercise of market power.
So if the guidelines are telling you to include only those that are necessary in order to effectuate a price increase over competitive levels, so that was the only part I was pushing back on.
It's not all competitive constraints, right? It's not every one under the sun. And maybe we could define what you mean by competitive. But -- but I took it to mean literally any competitive including weak, right? We don't need weak constraints to be

Exhibit E5

Public Redacted Version

EXHIBIT 6
FILED UNDER SEAL

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

IN RE GOOGLE PLAY STORE ANTITRUST LITIGATION THIS DOCUMENT RELATES TO: *In re Google Play Consumer Antitrust Litigation*, Case No. 3:20-cv-05761-JD *State of Utah et al. v. Google LLC et al.*, Case No. 3:21-cv-05227-JD	No. 3:21-md-02981-JD **MERITS REPLY REPORT OF** **HAL J. SINGER, PH.D.** Judge: Hon. James Donato

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INTRODUCTION AND SUMMARY OF CONCLUSIONS

1. I have been asked by counsel for Consumer Plaintiffs to respond to the expert reports of Drs. Gregory Leonard,[1] Matthew Gentzkow,[2] Catherine Tucker,[3] and Douglas Skinner[4] (collectively, the "Google Experts"). As detailed below, having carefully considered the reports of the Google Experts, I am not inclined to materially alter the opinions expressed in my report on the merits of this case ("Merits Report"), or those in my prior class certification reports.[5]

QUALIFICATIONS

2. My qualifications are provided in my prior reports.

I. DR. LEONARD FAILS TO UNDERMINE MY CONCLUSIONS

3. Below I explain why Dr. Leonard's critiques of my analysis do not undermine my conclusions. As a preliminary matter, I note that Dr. Leonard and other Google economists claim that modeling a competitive but-for world in this case requires a degree of specificity that would be impractical or impossible to satisfy in any antitrust case.[6] None of the Google economists explain what economic models might possibly satisfy the conditions that they articulate or the data

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1. Expert Report of Dr. Gregory K. Leonard (November 18, 2022) [hereafter, Leonard Report].
2. Expert Report of Matthew Gentzkow (November 18, 2022) [hereafter, Gentzkow Report].
3. Expert Report of Catherine E. Tucker (November 18, 2022) [hereafter, Tucker Report].
4. Expert Report of Douglas J. Skinner (November 18, 2022) [hereafter, Skinner Report].
5. Merits Report of Hal J. Singer, Ph.D. (October 3, 2022) [hereafter, Singer Merits Report]. Unless otherwise defined, capitalized terms herein are defined the same as they are in the Singer Merits Report, and in my class certification reports. *See* Class Certification Report of Hal J. Singer, PhD (February 28, 2022) [hereafter, "Singer Class Cert Report"]; *see also* Class Certification Reply Report of Hal J. Singer, PhD (April 25, 2022) [hereafter, "Singer Class Cert Reply"]; *see also* Class Certification Reply Report of Hal J. Singer, PhD (Errata) (May 10, 2022) [hereafter, "Singer Class Cert Reply Errata"]. The materials I relied upon in forming my opinions are noted in the footnotes throughout this report or otherwise listed in Appendix 1, or in my prior reports. I reserve the right to supplement, expand, or amend my opinions. All of my economic models use Play Store transaction data produced by Google ("Google Transactional Data"). The Google Transactional Data includes billions of records, and was produced in two batches. The first batch (GOOG-PLAY-007203251) was produced on July 27, 2021, and includes U.S. transactions from November 2010 through July 3, 2021. The second batch was produced on August 17, 2022, and includes U.S. transactions between July 4, 2021 through May 31, 2022. As of the filing date of my Merits Report (October 3, 2022), portions of the second batch had not been fully incorporated into my analysis due to the substantial computational burden of processing and analyzing billions of records. On October 19, 2022, I produced an amended version of my Merits Report reflecting the fully processed transaction data. This update did not materially alter my conclusions.
6. Leonard Report ¶¶27-29 ("Specifying the but-for world is a complex undertaking…In this case, the important aspects of the but-for world that are relevant for Plaintiffs' experts damages calculations, but that they either did not address at all or did not address clearly include (1) what app stores or types of app stores would have entered, when would they have entered, what devices would they be on, and which apps would have been available in those stores; (2) how Google would have changed its level of investment in Android, Google Play and app developer support; (3) if, how, and why Google would have changed its monetization strategy; (4) how consumers would have been affected by the existence of additional app stores (e.g., greater search costs or increased malware on Android devices); (5) how developers would have been affected by the existence of additional app stores and/or multiple Android-based OSs (e.g., greater distribution costs required with multiple stores or multiple OSs); (6) to the extent there is a claim that there would have been additional apps in the but-for world, the identity, attributes, and quality of those apps; and so on."). *See also* Gentzkow Report ¶636.

that would be required to implement them, because such models do not exist, and the data requirements would likely be impossible to satisfy in any event.

A. Dr. Leonard Fails to Undermine the Standard Economics and Rigorous Empirical Analysis That I Use to Establish Pass-Through

4. In my Merits Report, I explained why, as a matter of standard economic principles, profit-maximizing firms engage in pass-through: When their costs increase, firms have a clear economic incentive to charge higher prices; conversely, when costs decrease, the incentive is to reduce prices to increase volume of sales, thus maximizing profit.[7] The "pass-through rate" gives the change in a firm's profit-maximizing price resulting from a given change in marginal cost.[8] To assess the pass-through rate in this case, I applied standard economic models and standard econometric methods to Google's voluminous transaction data.

5. I have previously explained why Google's limited take rate reductions in the actual world do not provide a reliable basis for estimating the market-wide pass-through that would have occurred in a more competitive but-for world.[9] Nevertheless, Dr. Leonard attempts to estimate pass-through using flawed, SKU-level comparisons similar to those employed by Google's class certification expert (Dr. Burtis).[10] I explain why Dr. Leonard's analysis is flawed and unreliable in Part I.A.4 below.

6. Instead of Dr. Leonard's unreliable approach to estimating pass-through, I used standard econometric methods to measure the shape of the demand curve facing app developers, which determines the pass-through rate, and concluded that the standard logit model fits the data well.[11] Dr. Leonard claims that "today it is uncommon for an empirical economics research study to use this [logit] model."[12] Dr. Leonard is wrong. My Merits Report cites published, peer-

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7. Singer Merits Report Parts VI.D.1-2.

8. For example, if a firm's costs increase by $10 per unit, and the firm responds by raising its price by $5, the pass-through rate is $5/$10 = 50 percent. Dr. Leonard agrees with this definition. Leonard Report ¶30.

9. In a more competitive but-for world, all or almost all developers would enjoy substantially and permanently lower take rates. *See, e.g.,* Singer Class Reply ¶10. In contrast, Google's take rate reductions have been generally limited to narrowly defined SKUs comprising a small share of developer revenue, and/or short time horizons, making it unlikely that any change take rates would have had a material effect on developer finances or pricing. *See, e.g.,* Singer Class Reply ¶103; ¶126. In addition, Google's 2018 reduction in subscription take rates applied only to users that had maintained their subscriptions for at least one year. If a consumer has subscribed to a product for a year (or more) and paid the same monthly price, that consumer has revealed a strong willingness to pay for the subscription offering, and it would make little economic sense for a developer to target price cuts to its least price-sensitive customers. *Id.* at ¶119. Moreover, the pricing rules in the Play Store's developer interface likely made it difficult or impossible for most developers to drop prices to subscribers after the first year, even if they had wanted to do so. *Id.* at ¶122. In addition, developers would be incentivized to pass on savings from a lower take rate via steering and discounting, to induce consumers to switch to the low-cost provider. These incentives are absent in the actual world. Developers that enjoyed Google's limited take-rate decreases in the actual world did not have to share any of the savings with their customers in order to realize the cost savings. Singer Merits Report ¶369.

10. Singer Class Reply ¶¶123-133.

11. Singer Merits Report Part VI.D.3.

12. Leonard Report ¶72. Dr. Leonard claims that the logit model is "highly restrictive." *Id.* In fact, economists recognize that "the logit model is the ideal rather than a restriction." Kenneth Train, *Logit, in* DISCRETE CHOICE METHODS WITH SIMULATION, 36 (Cambridge University Press 2009).

reviewed research demonstrating otherwise.[13] Among many other things, I cite to a peer-reviewed 2018 article authored by academics and DOJ economists explaining that logit is one of the primary models included in the antitrust software package developed by DOJ economists.[14] This article and others that I cite were published more recently than all the papers that Dr. Leonard relies upon to support his incorrect claim, most of which were published in the 1980s or 1990s.[15]

7. Dr. Leonard does not dispute that the standard logit demand systems that I used to calculate pass-through explain over 95 percent of the variation in consumer demand in the voluminous Google transaction data.[16] Nor does he dispute that, consistent with economic expectations, the logit regression results confirm a negative and highly statistically significant relationship between demand and price.[17] Instead, Dr. Leonard claims erroneously that I did not provide sufficient empirical justification for the standard logit demand systems that I employ here.[18] I follow standard practice in empirical antitrust work, in which the form of the demand curve is assessed based on "how well the model fits the observable data."[19]

8. In my Merits Report, I also provided corroborative empirical evidence of pass-through by demonstrating that higher tax rates (which as I discuss below are economically analogous to higher take rates) are systematically passed on by developers to consumers in the form of higher prices.[20] The combination of standard economic principles and my empirical analysis allowed me to conclude that lower take rates would have resulted in lower prices for consumers in a more competitive but-for world and to quantify the resulting overcharge for purposes of determining impact and calculating damages to consumers in the United States who purchased Apps or In-App Content.[21]

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13. Singer Merits Report ¶348, n. 809; ¶356, n. 835.

14. Singer Merits Report ¶348, n. 809, citing Luke Froeb et al., *Economics at the Antitrust Division: 2017–2018*, 53 REVIEW OF INDUSTRIAL ORGANIZATION 637, 639-642 (2018).

15. Leonard Report ¶72, n. 76. Dr. Leonard relies upon papers that advocate "random coefficient" logit models (or "mixed logit" models), which are sometimes used by academics, but seldom by antitrust practitioners. As I explained in my Merits Report, in practice, these techniques suffer from well-documented computational problems, which can severely limit their applicability and accuracy when applied to real-world data sets. Singer Merits Report ¶348, n. 810.

16. Singer Merits Report ¶354.

17. *Id.*

18. Leonard Report ¶¶68-72.

19. Luke Froeb et. al., *Economics at the Antitrust Division: 2017–2018*, 53 REVIEW OF INDUSTRIAL ORGANIZATION 637, 640 (2018). The approach I adopt is more rigorous than assuming that the demand curve has a standard form (such as logit) and then calibrating the demand system to the data based on that assumption. *See, e.g.,* Nathan Miller, Marc Remer, & Gloria Sheu, *Using cost pass-through to calibrate demand*, 118 ECONOMICS LETTERS 451 (2013) ("Researchers in industrial economics frequently conduct counter-factual experiments based on parameterized systems of consumer demand. *The functional form of demand is assumed* and the structural parameters are either estimated from data or calibrated.") (emphasis added). *See also* Froeb et. al. (2018), *supra*, at 640-643. As shown in Appendix 3, linear demand does not fit the data well. Contrary to economics, the price coefficients are statistically insignificant in 12 out of the 33 regressions. By contrast, the price coefficients are statistically significant for each and every app category for the logit model. Singer Merits Report Table 12.

20. Singer Merits Report Part VI.D.4.b.

21. In my Merits Report, I demonstrated empirically that my damages models can accommodate focal-point pricing, and that at most a *de minimis* share of apps would not lower price due to focal-point pricing in the but-for

1. Dr. Leonard Baselessly Rejects Standard Economic Methods Deriving Pass-Through From a Market-Wide Change in Costs

9. In a more competitive but-for world, all or almost all developers would benefit from substantially and permanently lower costs, owing to substantially and permanently lower take rates. Accordingly, in my Merits Report, I estimated the pass-through rate by applying standard economic calculations of market-wide cost-pass-through.[22] These calculations solve for each developer's profit-maximizing price decrease to consumers, given what other developers are charging in light of lower market-wide costs.[23] This provides the correct pass-through rate—namely, the extent to which prices for App and In-App Content would decline in the but-for world, given the market-wide decrease in cost that would occur, pushing the market to a new, more competitive equilibrium. Consistent with standard practice, I calculated the change in equilibrium prices resulting from a lower take rate by multiplying (1) the decrease in cost resulting from a lower take rate by (2) the pass-through rate.[24]

10. Without citation to any authority, Dr. Leonard erroneously claims that the "correct way" to solve for the pass-through rate "is to ask the question, '[H]ow the service fee *rate* change would affect the profit maximizing price?'"[25] In making this unsupported claim, Dr. Leonard ignores the elementary economic fact that developers adjust their prices based on changes in their actual costs (in dollars), not in the "service fee rate" per se (which is not a dollar amount). Dr. Leonard's calculations in Appendix D of his report proceed from this flawed premise[26] despite the fact that what matters for pass-through is the change in costs resulting from a change in the take rate, which is what I have calculated.[27]

11. Dr. Leonard's error is compounded by the fact that his calculations do not account for the market-wide nature of the cost decrease that would occur in a more competitive but-for world; Dr. Leonard's calculations in Appendix D of his report are limited to how a single developer reacts to a change in its own take rate. In other words, Dr. Leonard's calculations in Appendix D

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world. Singer Merits Report ¶¶408-413. Dr. Leonard ignores this quantitative analysis. Leonard Report ¶31, n. 5. Dr. Leonard claims incorrectly that the lack of steering in the actual world contributes to focal-point pricing. Leonard Report ¶32, n. 7. In fact, developers in the but-for world would have economic incentives to depart from focal-point pricing in increments of $1; moreover, in the few episodes where we do observe steering in the actual world, developers have been observed to deviate from $1 pricing increments. Singer Merits Report ¶405. In addition, Apple recently announced new price points in App Store. In addition to allowing ten-cent intervals, Apple also lowered its minimum price from $0.99 to $0.29. This provides additional evidence that focal-point pricing in $1 increments is far from economically inevitable. *See* Apple, *Apple announces biggest upgrade to App Store pricing, adding 700 new price points* (Dec. 6, 2022), https://www.apple.com/newsroom/2022/12/apple-announces-biggest-upgrade-to-app-store-pricing-adding-700-new-price-points/.

22. Singer Merits Report ¶¶358-360.

23. Singer Merits Report ¶¶358-360; ¶337, n. 795.

24. Singer Merits Report ¶363; ¶337 n. 795.

25. Leonard Report Appendix D, ¶2 (emphasis in original).

26. Leonard Report Appendix D, ¶2 ("That is, the correct calculation would be based on $\partial P/\partial t$, where P is the app price set by an app developer and t is the service fee rate.")

27. Singer Merits Report ¶363; ¶337 n. 795.

do not account for the fact that developers would decrease their prices in response to other developers' price cuts.[28]

12. Despite the voluminous empirical econometric literature on pass-through, Dr. Leonard does not (and cannot) cite to a single instance of his formula ever being used in a peer-reviewed research article (or anywhere else) for any purpose, let alone to calculate pass-through.

2. Dr. Leonard Baselessly Rejects Standard Econometric Methods Demonstrating Developer Pass-Through of *Ad Valorem* Sales Taxes

13. In Table 15 of my Merits Report, I applied standard regression methods to Google's transaction data to demonstrate empirically that developers systematically pass on higher tax rates imposed by state or local authorities (that is, higher *ad valorem* costs) in the form of higher prices paid by Consumer Plaintiffs.[29] Dr. Leonard mistakenly claims that these regressions are "mathematically guaranteed" to show 100 percent pass-through.[30] To support this claim, Dr. Leonard misleadingly focuses on one of the regressions (column (1) of Table 15 of my Merits Report).[31] Dr. Leonard conveniently ignores the very next column of Table 15, which shows pass-through less than 100 percent: According to column (2) of Table 15, a one percentage-point increase in the sales tax rate leads to a 0.7 percent increase in the post-tax price. To illustrate, suppose that the post-tax price of an App is initially $2.00, and that the tax rate is five percent, so that the pre-tax price is $2.00/(1.05) = $1.90. If the tax rate increases by five percentage points (to ten percent), the post-tax price will increase by [0.7 percent x 5] = 3.5 percent, resulting in a new post-tax price of [$2.00 x 1.035] = $2.07. The new pre-tax price will be $2.07/1.10 = $1.88. The pass-through rate in this example is 75 percent (equal to the change in the post-tax price divided by the change in the tax amount, or [$2.07 - $2.00]/[($2.07 -$1.88) - ($2.00 -$1.90)]). The pass-through rate is below 100 percent because the developer decreases its pre-tax price in response to an increase in the tax rate.

14. Dr. Leonard claims my regressions in Table 15 do not measure pass-through because developers lack the "ability to adjust pre-tax prices in response to tax rate variation as a way to absorb taxes."[32] This is incorrect; developers are free to adjust the pre-tax price in response to anything they choose, including sales taxes. More fundamentally, Dr. Leonard ignores the elementary economic principle that, when a tax is levied on a product or service, the pass-through rate determines the extent to which a consumer bears the cost of the tax; this is true regardless of whether the tax is levied on the firm or on the consumer.[33] Therefore, the extent to which the

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28. Leonard Report Appendix D, ¶¶5-6 (Equations (A.2) - (A.9) are solved individually, instead of on a marketwide basis).

29. Singer Merits Report ¶368.

30. Leonard Report ¶82.

31. Leonard Report ¶82.

32. Leonard Report ¶81.

33. Singer Merits Report ¶367, citing N. GREGORY MANKIW, PRINCIPLES OF MICROECONOMICS 120-127 (Cengage Learning 8th ed. 2018) [hereafter, MANKIW]. MANKIW at 123 ("*Taxes levied on sellers and taxes levied on buyers are equivalent*. In both cases, the tax places a wedge between the price that buyers pay and the price that sellers receive. The wedge between the buyers' price and the sellers' price is the same, regardless of whether the tax is levied on buyers or sellers…The only difference between a tax levied on sellers and a tax levied on buyers is who sends the

before-tax price does or does not adjust in response to a change in the tax rate is directly informative of the pass-through rate. The regressions in Table 15 of my Merits Report are grounded in these standard principles.

15. Dr. Leonard claims that "Google's system does not allow developers to systematically set different pre-tax prices for different states in the US," but my regressions do not rely on "tax variation across states."[34] Dr. Leonard ignores that my regressions control for state fixed effects.[35] The inclusion of state fixed effects means that my regressions do not measure pass-through by comparing tax rates and prices across different states, as Dr. Leonard mistakenly suggests.[36]

3. Dr. Leonard Baselessly Rejects Standard Economic Principles of Pass-Through

16. In the past in his own published work, Dr. Leonard has acknowledged the standard economic principle that firms charge higher prices when their costs are higher and lower prices when costs are lower. He has written: "Economic theory makes a straightforward prediction: The decrease in cost will lead to a decrease in price, with the relationship between the decreases in cost and price depending on the shape of the demand curve."[37] As Dr. Leonard makes clear in his article, these fundamental conclusions regarding pass-through are not just abstract theoretical results; they apply directly to real-world economic outcomes.[38] Yet Dr. Leonard critiques me for estimating pass-through based on the shape of the demand curve in this case.[39]

17. In contrast, in his expert report, Dr. Leonard distances his opinions from these fundamental economic principles. Dr. Leonard claims baselessly that pass-through could be "negative" in the context of App pricing. In other words, Dr. Leonard speculates that developers

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money to the government.") (emphasis in original). Dr. Leonard ignores this basic principle when he claims that my regression is "uninformative about the pass-through of service fees," because "while the service fees are levied directly on the developers, sales taxes are levied directly on consumers." Leonard Report ¶81.

34. Leonard Report ¶81.

35. Singer Merits Report ¶368, Table 15 ("Fixed effects in column (2) are unique to App name, App subproduct, purchase type (App sale, In-App purchase, subscription), *customer state*, App category, and year. Fixed effects in column (1) are the same, except that they are not year-specific.") (emphasis added).

36. In Appendix 4, I demonstrate this point further by collapsing the data used in Table 15 down to the nationwide level; the regression results continue to show a positive and highly statistically significant relationship between the tax rate and the price.

37. Jerry Hausman & Greg Leonard, *Efficiencies from the Consumer Viewpoint,* 17(3) GEORGE MASON LAW REVIEW 707, 708 (1999) [hereafter Hausman & Leonard] ("What would be the effect on prices to consumers from the cost reduction? Economic theory makes a straightforward prediction: The decrease in cost will lead to a decrease in price, with the relationship between the decreases in cost and price depending on the shape of the demand curve.").

38. *Id.* ("[W]e have been continually surprised over the years that many lawyers at the antitrust agencies refuse to accept this proposition and instead claim that a monopolist will 'pocket the cost savings' and not pass any of them on to consumers. This claim is based on the incorrect assertion that only competition forces a firm to pass along cost savings. In fact, however, profit maximization by the firm causes it to pass along at least some of the cost savings in terms of a lower price, even if the firm is a monopolist.").

39. Dr. Leonard now claims that the analysis in Hausman & Leonard, *supra*, was limited to "discussing per unit marginal cost instead of the pertinent *ad valorem* cost." Leonard Report ¶63. In fact, any change in costs resulting from a lower take rate can be expressed equivalently as a change in per-unit costs. Singer Merits Report ¶363; ¶337 n. 795.

would *increase* their prices to the Consumer Class as a result of a *decrease* in their costs.[40] In a failed attempt to support this novel claim, Dr. Leonard offers a single, purely hypothetical example that does not make economic sense:

> Suppose a developer monetizes through both paid content and advertising. Following a service fee rate reduction, the developer may find it more profitable to increase the price (hence making more profit per sale) and lower the intensity of advertising (hence forgoing advertising revenue but at the same time limiting the reduction in consumer demand due to consumers' preference for less advertising). The more consumers value the app and the more consumers dislike advertising, the more appealing this change in pricing strategy may be for the developer. This would lead to a negative pass-through.[41]

18. Dr. Leonard's hypothetical contradicts elementary economics because it assumes nonsensically that developers would not initially maximize profit with respect to their advertising decisions, but would only belatedly decide to begin maximizing profit after the take rate falls. If the developer in this hypothetical were economically rational, it would set advertising intensity to maximize profit before the decline in the take rate. When the take rate declines, this would have no effect on the on the intensity of advertising that consumers are willing to tolerate. Therefore, Dr. Leonard's speculation that the developer would lower the advertising intensity and raise the price in response to a decrease in the take rate does not make economic sense. The lone reference that Dr. Leonard provides when putting forth his "negative pass-through" claim provides no support for it.[42]

4. Dr. Leonard's Empirical Estimates of Pass-Through Are Biased and Unreliable

19. Dr. Leonard attempts to measure pass-through using Google's limited take rate reductions in the actual world.[43] I have previously explained why this approach does not provide a reliable basis for estimating the market-wide pass-through that would have occurred in a more competitive but-for world:

- In a more competitive but-for world, all or almost all developers would enjoy substantially and permanently lower take rates.[44] In contrast, Google's recent take rate reductions have generally been limited to narrowly defined SKUs comprising a small share of developer revenue, and/or short time horizons, making it unlikely

40. Leonard Report ¶33.
41. *Id.*
42. *Id.*, citing Anja Lambrecht et. al., *How do firms make money selling digital goods online?* 25(3) MARKETING LETTERS 331-341 (2014) [hereafter, Lambrecht et. al.]. This article provides no support for Dr. Leonard's "negative pass-through" claim. The article does not deal with pass-through at all. It provides a review of "how digital business raise revenue," and concludes by emphasizing that the research is still "in its infancy." Lambrecht et. al. at 339 ("**Conclusion[:]** In this review, we have discussed how digital businesses raise revenue. We have emphasized the strengths and weaknesses of the various revenue generators and the challenges that businesses face in earning revenue online. The literature has emphasized that selling subscriptions, advertising, and customer information can all sustain digital businesses, but this research is still in its infancy.")
43. Leonard Report ¶¶34-51.
44. Singer Class Reply Figure 1 (showing the vast majority of take rates between 29 and 30 percent). *Id.* Figure 2 (among take rates above 29 percent, and the vast majority are above 29.9 percent).

that any change in take rates would have had a sufficiently large and/or sustained effect on developer finances to be reflected in their pricing.[45]

- Google's 2018 reduction in subscription take rates applied only to users that had maintained their subscriptions for at least one year. If a consumer has subscribed to a product for a year (or more) and paid the same monthly price, that consumer has revealed a strong willingness to pay for the subscription offering, and it would make little economic sense for a developer to target price cuts to its least price-sensitive customers.[46] Moreover, the pricing rules in the Play Store's developer interface likely made it difficult or impossible for most developers to drop prices to subscribers after the first year, even if they had wanted to do so.[47]

- Price "stickiness," which arises due to well-understood behavioral economic phenomena such as consumer anchoring,[48] would tend to limit pass-through in the actual world, while facilitating lower prices in the but-for world.[49] Dr. Leonard claims incorrectly that I "fail[] to recognize that any such price stickiness also would be present in the but-for world and would prevent the pass-through of a lower but-for service fee."[50] This is incorrect; as I have explained, in the but-for world, lower take rates would influence developer pricing from the inception of a developer's products, which is why price stickiness would facilitate lower prices in the but-for world.[51]

- In a more competitive but-for world, developers would be incentivized to pass on savings from a lower take rate via steering and discounting to induce consumers to switch to the low-cost provider. These incentives are absent in the actual world;

45. *See, e.g.,* Singer Class Reply ¶103; ¶126.

46. *Id.* at ¶119.

47. *Id.* at ¶122.

48. *See, e.g.,* Amos Tversky & Daniel Kahneman, *Judgment under Uncertainty: Heuristics and Biases*, 184 SCIENCE 1124, 1128 (1974) ("In many situations, people make estimates by starting from an initial value that is adjusted to yield the final answer…different starting points yield different estimates, which are biased toward the initial values. We call this phenomenon anchoring."). *See also*, Andrea Caceres-Santamaria, *The Anchoring Effect*, Federal Reserve Bank of St. Louis (2021), https://research.stlouisfed.org/publications/page1-econ/2021/04/01/the-anchoring-effect ("[I]t's the initial price a consumer is exposed to that becomes a consistent reference point when shopping around. The tendency for a person to rely heavily on the first piece of information they receive when making decisions is known as the anchoring effect…Anchoring plays a role in decisions that involve numerical values such as prices…Retailers are very aware that price anchors are an effective tool they can use in their pricing strategy.").

49. Singer Merits Report ¶370 ("When a new App (or a new form of In-App Content) is developed, a profit-maximizing developer selects a price that maximizes expected profit over the long run, taking into account costs incurred over the long run. To ensure a sufficient rate of return on its investment, a developer faced with the prospect of paying 30 percent of its revenue to Google in perpetuity will (all else equal) need to charge a higher price to consumers than a developer facing a lower take rate. Price stickiness implies that the initial price chosen for an App (or In-App Content) will influence subsequent pricing, and hence reinforces developers' incentives to select an initial price that takes all costs (including the take rate) into account. Because developer costs would have been permanently and substantially lower due to lower take rates, prices would have been permanently and substantially lower for all or almost all developers. Thus, lower take rates would influence developer pricing from the inception of their Apps (or In-App Content).").

50. Leonard Report ¶53.

51. Singer Merits Report ¶370.

developers that enjoyed Google's limited take-rate decreases in the actual world did not have to share any of the savings with their customers in order to realize the cost savings.[52]

For these reasons, and for additional reasons detailed below, Dr. Leonard's empirical estimates of pass-through are biased and unreliable.

a. Dr. Leonard's "Real-World Examples" Do Not Reliably Estimate Pass-Through In the But-For World

20. Dr. Leonard begins his analysis with comparisons of average prices, which he labels "real-world examples."[53] Dr. Leonard's "real-world examples" consist of simple before-and-after SKU-level price comparisons and make no attempt to control for factors that may influence developer pricing decisions.[54] Dr. Leonard's "real-world examples" suffer from many of the flaws listed in the prior section.[55] Moreover, as detailed below, simply adjusting Dr. Leonard's "real-world examples" for the substantial inflation that characterizes his sample period reverses his results.

21. Dr. Leonard's examples comprise too small a dataset from which to draw any conclusions. In Table 1 of his report, Dr. Leonard selects the "top 100 paid SKUs" whose take rate fell from 30 percent to 15 percent after Google decreased the take rate for small developers in mid-2021. These so-called "top 100" SKUs had aggregate consumer purchases of just [redacted] over the time period covered by Table 1 (July 2020 – May 2022). This represents less than [redacted] percent of aggregate purchases by Consumer Plaintiffs over this time period, underscoring the very limited aggregate effect of Google's reduction in take rates to small developers. More generally, Dr. Leonard's "real-world examples" in Tables 1 – 5 represent approximately [redacted] percent of aggregate purchases by Consumer Plaintiffs over this time period.

22. For the 100 SKUs in Table 1 of his report, Dr. Leonard compares (1) the average price for the twelve-month period between July 2020 – June 2021 to (2) the average price for the eleven-month period between July 2021 – May 2022. Dr. Leonard finds that the price increased for 32 of these SKUs, and decreased for 23 SKUs, and remained unchanged for 45 SKUs. According to Dr. Leonard, because only 23 out of these 100 SKUs decreased their prices in the

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52. Singer Merits Report ¶369.
53. Leonard Report ¶10(d); ¶31; ¶36.
54. For example, there is evidence that the price of "[redacted]" may have increased due to new features added in March 2022. Specifically, the developer released an [redacted]. *See* [redacted]. The start of the final price increase in Figure 2 of Dr. Leonard's report corresponds to this March 2022 release.
55. To summarize: Dr. Leonard's examples are necessarily limited Google's recent take rate reductions, and hence to narrowly defined SKUs comprising a small share of developer revenue, as well as short time horizons. Dr. Leonard ignores price stickiness, which would limit pass-through in the actual world, while facilitating lower prices in the but-for world. Dr. Leonard's "real-world examples" do not reflect incentives for steering and discounting that would be present in the but-for world; in contrast developers did not have to share any of the savings with their customers in order to realize the cost savings in the actual world.

eleven months following the take rate change, there is "little evidence of positive pass-through in response to the service fee rate reduction."[56]

23. It also bears emphasis that the full effect of the lower take rate would take time to be reflected in a developers' financials and would be inherently unpredictable given the structure of Google's take rates. Consider a developer selling one of the SKUs in Table 1. At the end of July 2021, when the lower take rate of 15 percent had been in effect for approximately one month, Google's average take rate from the developer over the past year would be 28.8 percent.[57]At the end of August 2021, Google's average take rate from the developer over the past year would be 27.5 percent,[58] and so on. Given evidence of price stickiness in the industry, it would be surprising if the developer chose to adjust its prices downward bit by bit, month by month, to reflect the downward trajectory of the take rate on average over all of its SKUs. Dr. Leonard himself relies on economic literature providing evidence of "rigid pricing structures" driven by concerns of "user-friendliness."[59] Despite price stickiness, the developer *might* consider making price adjustments *if* the impact of the lower take rate on its finances were stable and predictable, allowing the developer to commit to a new lower price on a permanent (or semipermanent) basis. For example, the developer might revisit its pricing after a full year (that is, one month after the end of Dr. Leonard's sample). But even then, the developer's take rate going forward is likely to be inherently unpredictable, because Google's 15 percent take rate applies only to the first $1 million in revenue. If the developer expects (or hopes) that its annual revenue will increase above $1 million going forward, its take rate will also increase going forward, placing upward pressure on future pricing. This uncertainty would make it unlikely that the developer could commit to a new, lower price.

24. For all of his "real-world examples," Dr. Leonard ignores that there was substantial inflation over the time period he studies. In an inflationary environment, firms will tend to be reluctant to decrease the nominal price of their products; even holding the nominal price constant is tantamount to a reduction in the real price. As shown illustrated below and in Appendix Table A1, when I express prices in real terms, I find that the real price decreased for 78 out of the 100 SKUs in Dr. Leonard's Table 1, with an average decrease of six percent.

56. Leonard Report ¶38.
57. Equal to [30* 11 + 15]/12.
58. Equal to [30* 10 + 15*2]/12.
59. *See* Lambrecht et. al., *supra*, at 334 ("[M]any firms use rigid pricing structures across time and content, mainly for user-friendliness.").

FIGURE 1: AVERAGE REAL NET PRICE OF PAID APPS IN LEONARD TABLES 1-3
PRE- AND POST-JULY 2021 TAKE RATE REDUCTION

[redacted]

Sources: Appendix 2; Leonard Backup; Google Play transactions data; GOOG-PLAY-007203251; GOOG-PLAY3-000018260; FRED, *Consumer Price Index for All Urban Consumers: All Items in U.S. City Average*, *available at* https://fred.stlouisfed.org/series/CPIAUCSL. Prices adjusted for inflation using CPI with base month 7/2020. Pre-period is defined as 2020.07.01 - 2021.06.30. Post-period is 2021.07.01 - 2022.05.31.

25. In Table 2 of his report, Dr. Leonard selects the "top 100 paid SKUs" whose take rate fell at least ten percentage points after Google decreased the take rate for small developers in mid-2021. For the 100 SKUs in Table 2, Dr. Leonard again compares (1) the average price for the twelve-month period between July 2020 – June 2021 to (2) the average price for the eleven-month period between July 2021 – May 2022. Dr. Leonard finds that the price increased for 37 of these SKUs, decreased for 22 SKUs, and remained unchanged for 41 SKUs.

26. Dr. Leonard's Table 2 is flawed and unreliable for the same reasons given above for Table 1. As shown above, and in Appendix Table A2, when I express prices in real terms, I find that the real price decreased for 75 out of the 100 SKUs in Dr. Leonard's Table 2, with an average decrease of five percent.

27. In Table 3 of his report, Dr. Leonard selects the "top 100 paid apps ranked by consumer spend among all paid apps." For the 100 SKUs in Table 3, Dr. Leonard again compares (1) the average price for the twelve-month period between July 2020 – June 2021 to (2) the average price for the

price for the eleven-month period between July 2021 – May 2022. Dr. Leonard finds that the price increased for 32 of these SKUs, decreased for 12 SKUs, and remained unchanged for 56 SKUs.

28. Dr. Leonard's Table 3 is flawed and unreliable for the same reasons given above for Table 1. In addition, because the average take rate for these SKUs declined by only eight percentage points (from 30 percent to 22 percent), the take rate decrease would take even longer to be reflected in developers' financials. Further, the SKUs in Dr. Leonard's Table 3 account for just [redacted] percent of consumer expenditure for the developers that sell these SKUs. This makes it even less likely that these developers would make price adjustments based on the lower take rates shown in Table 3, given that developers make pricing decisions at the firm level, as opposed to the SKU level. As shown above and in Appendix Table A3, when I express prices in real terms, I find that the real price decreased for 79 out of the 100 SKUs in Dr. Leonard's Table 3, with an average decrease of four percent.

FIGURE 2: AVERAGE REAL NET PRICE OF IAPS IN LEONARD TABLES 4-5
PRE- AND POST-JULY 2021 TAKE RATE REDUCTION

[redacted]

Sources: *See* Figure 1, *supra*.

29. In Table 4 of his report, Dr. Leonard selects the "Top 100 IAPs with A Flat Service Fee Rate Reduction of 15 Percentage Points." For the 100 SKUs in Table 4, Dr. Leonard again compares (1) the average price for the twelve-month period between July 2020 – June 2021 to (2) the average price for the eleven-month period between July 2021 – May 2022. Dr. Leonard finds

that the price increased for 14 of these SKUs, decreased for one SKU, and remained unchanged for 85 SKUs.

30. Dr. Leonard's Table 4 is flawed and unreliable for the same reasons given above for Table 1. In addition, the SKUs in Dr. Leonard's Table 4 account for [redacted] of consumer expenditure for the developers that sell these SKUs. This makes it even less likely that these developers would make price adjustments based on the lower take rates shown in Table 4, given that developers make pricing decisions at the firm level, as opposed to the SKU level. Further, as shown above and in Appendix Table A4, when I express prices in real terms, I find that the real price decreased for 92 out of the 100 SKUs in Dr. Leonard's Table 4, with an average decrease of three percent.

31. In Table 5 of his report, Dr. Leonard selects the "Top 100 IAPs with A Service Fee Rate Reduction of At Least 10 Percentage Points." For the 100 SKUs in Table 5, Dr. Leonard again compares (1) the average price for the twelve-month period between July 2020 – June 2021 to (2) the average price for the eleven-month period between July 2021 – May 2022. Dr. Leonard finds that the price increased for 9 of these SKUs, decreased for one SKU, and remained unchanged for 90 SKUs.

32. Dr. Leonard's Table 5 is flawed and unreliable for the same reasons given above for Table 1. In addition, the SKUs in Dr. Leonard's Table 5 account for [redacted] of consumer expenditure for the developers that sell these SKUs. This makes it even less likely that these developers would make price adjustments based on the lower take rates shown in Table 5, given that developers make pricing decisions at the firm level, as opposed to the SKU level. Further, as shown above and in Appendix Table A5, when I express prices in real terms, I find that the real price decreased for 96 out of the 100 SKUs in Dr. Leonard's Table 5, with an average decrease of six percent.

33. Dr. Leonard declined to present a "real-world analysis" on any subscription developer (other than Tinder), despite having plentiful data on subscription developers available to him. As seen below and in Appendix Tables A6-A8, when I conduct an analysis of subscription SKUs analogous to Dr. Leonard's, I find that the real price decreased for 93 out of the top subscription 100 SKUs with a take rate reduction of 15 percentage points after July 2021, with an average decrease of five percent.

FIGURE 3: AVERAGE REAL NET PRICE TOP SUBSCRIPTION SKUS
PRE- AND POST-JULY 2021 TAKE RATE REDUCTION

[redacted]

34. Dr. Leonard's Table 7, which is specific to Tinder, is flawed and unreliable for many of the same reasons given above. In Table 7, Dr. Leonard first compares the average Tinder price between July 2020 and June 2021 to the average price between July 2021 and December 2021. Dr. Leonard finds that Tinder's average price increased from $36.70 to $42.39 over this interval, which likely reflects improvements to Tinder's offerings.[60] Dr. Leonard next compares the average price between July 2021 and December 2021 to the average price between January 2022 and May 2022. Tinder's take rate fell by approximately seven percent over this interval.[61] Dr. Leonard finds that the average Tinder price increased from $42.39 to $43.73, or about three percent. Over this interval, the Consumer Price Index increased by approximately four percent.[62]

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60. Tinder debuted its "Tinder Explore" feature in September 2021, which it described as "the biggest update to Tinder since the invention of the original Swipe feature," and which supported (among other things) searching for matches by interest, and made it easier for users to access exclusive social experiences. Tinder Press Room, *Tinder Opens This Fall's Hottest New Venue: Tinder Explore* (Sept. 8, 2021), https://www.tinderpressroom.com/2021-09-08-Tinder-Opens-This-Falls-Hottest-New-Venue-Tinder-Explore.

61. Leonard Report Table 7.

62. See, e.g., FRED, *Consumer Price Index for All Urban Consumers: All Items in U.S. City Average,* https://fred.stlouisfed.org/series/CPIAUCSL.

Thus, during the second interval in Dr. Leonard's Table 7, when Tinder's take rate fell the most, Tinder's real price also declined.

b. Dr. Leonard's "Synthetic Control" Regressions Do Not Reliably Estimate Pass-Through In the But-For World

35. Perhaps recognizing the deficiencies of his initial analysis, Dr. Leonard implements a "synthetic control" regression purporting to measure the pass-through rate.[63] In this analysis, Dr. Leonard relies on comparisons of two groups of SKUs. He calls one group "Treated SKUs," which he defines as "SKUs subject to a 29.5%-30.5% service fee rate in a pre period (from July 2020 to June 2021) and 14.5%-15.5% in a post period (from July 2021 to May 2022)."[64] He calls the other group "Control SKUs," which he defines as "SKUs subject to a 29.5%-30.5% service fee rate throughout July 2020 and May 2022."[65]

36. Dr. Leonard's synthetic control regressions suffer from many of the same flaws as his "real-world examples," which I have detailed above. Dr. Leonard's regressions use exactly the same time period as his "real-world examples," (July 2020 – May 2022) and divide the time period in exactly the same way.[66] As explained above, this makes it unlikely that any change in take rates would have had a sufficiently large and/or sustained effect on developer finances to be reflected in the observed prices.

37. As illustrated below, there are vast differences in the size of the developers in the two groups. For example, the average annual per-developer consumer expenditure in Dr. Leonard's "control group" comes to $[redacted] in 2021. In that year, the average annual per-developer consumer expenditure in Dr. Leonard's "treatment group" was approximately $[redacted].

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63. Leonard Report ¶¶47-51.
64. Leonard Report Exhibit 5, Note [1].
65. Leonard Report Exhibit 5, Note [1].
66. Leonard Report Exhibit 5, Note [1]; *see also* Appendix C, ¶6. As before, Dr. Leonard focuses on SKU-level comparisons, without regard to the extent to which a developer did (or did not) enjoy cost savings in the aggregate.

FIGURE 4: AVERAGE ANNUAL PER-DEVELOPER EXPENDITURE FOR DEVELOPERS IN DR. LEONARD'S PASS-THROUGH REGRESSION

[redacted]

Source: Leonard backup materials. In 2022, data are available through May; above they are annualized (multiplied by 12/5). As noted above, Dr. Leonard limits his analysis to July 2020 – May 2022.

38. Dr. Leonard's "treatment group" represents only a small fraction of consumer expenditure in the Play Store. Over the time period analyzed by Dr. Leonard (July 2020 – May 2022), consumer expenditures in Dr. Leonard's "treatment group" came to approximately [redacted] percent of aggregate purchases by Consumer Plaintiffs over this time period.[67]

39. More fundamentally, Dr. Leonard violates the necessary basis for synthetic control analysis: a clean control group (or "comparison group") from which the Challenged Conduct is absent.[68] None of the SKUs in Dr. Leonard's control group reflect pricing in a more competitive but-for world with substantially and permanently lower take rates for all or almost all developers

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67. Specifically, I summed up the final consumer spend of all observations in Leonard's regression data backup with a "treat_group" value equal to 1. This amounted to approximately [redacted]. I then divided this by the final consumer spend for all transactions over the period 7/2020—5/2022, equal to approximately [redacted].

68. Alberto Abadie, *Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects* 59(2) JOURNAL OF ECONOMIC LITERATURE 391, 409 (2021) ("[I]nference based on these methods will be faulty in the absence of a suitable comparison group…it is important that not all units adopt interventions similar to the one under investigation during the period of study.").

in the relevant markets at issue. In addition, Dr. Leonard has no way to control for price stickiness, which will influence pricing in both the control group and the treatment group. Predictably, Dr. Leonard's analysis produces nonsensical results inconsistent with standard economics; he is unable to determine even the sign of the pass-through rate, let alone the magnitude.[69]

B. Dr. Leonard Fails to Undermine the Well-Established Economic Models and Methods That I Use to Estimate Take Rates in a More Competitive But-For World

40. To calculate the take rate that would have prevailed in a more competitive but-for world, I used a standard two-sided platform pricing model developed by a Nobel prize-winning economist ("Rochet & Tirole (2003)").[70] Dr. Leonard does not dispute that this model is standard or that it is widely used by economists to analyze two-sided platforms. His critiques are limited to the inputs used to implement Rochet & Tirole (2003); as explained below, these critiques do not undermine my conclusions.

41. My economic model conservatively assumes that the Play Store would continue to retain a market share of approximately 60 percent of its prior level in the but-for world.[71] This is based my examination of the market shares of historically dominant firms that went on to face some degree of competition in different industries.[72] Sixty percent was approximately AT&T's market share in the long-distance market after competitive entry.[73] This estimate is conservative in relation to market share and concentration statistics for e-commerce markets, in which the payment method is generally not tied to the rest of the transaction.[74]

42. Dr. Leonard claims that AT&T's market share is not a suitable benchmark because the industry is not sufficiently "economically similar"[75] to the markets at issue here. In fact, AT&T was a prime example of a platform monopolist, benefitting from network effects, that leveraged monopoly power in the (ancillary) long-distance market from its monopoly in local service, before eventually being forced to open the long-distance market to competition—just as Google is a network monopolist that leveraged its power in the Android App Distribution Market into the In-App Aftermarket. Dr. Leonard ignores that economic models are not industry-specific; what matters the similarity in competitive dynamics across different industries.

43. Moreover, ample evidence from a range of additional industries, including network industries where market power was leveraged from the core into an ancillary market (such as Microsoft), supports my conclusion that Google's market share would have decreased substantially in a more competitive but-for world. If anything, the evidence shows that 60 percent is likely a conservative estimate of Google's market share after competitive entry.

69. Leonard Report ¶51.
70. Singer Merits Report Part VI.B.
71. Singer Merits Report ¶331.
72. Singer Merits Report ¶331; Singer Class Reply ¶¶91-94.
73. Singer Merits Report ¶331.
74. Singer Merits Report ¶331.
75. Leonard Report ¶92.

44. Netflix, which made streaming video on demand (SVOD) a staple of home entertainment, dominated the market for streaming video services for years.[76] As recently as 2014, approximately nine out of every ten SVOD households were Netflix subscribers.[77] More recently, Netflix's market share has eroded as competitors such as Amazon Prime, HBO Max, and others have gained at its expense.[78] As of Q4 2021, Netflix had a streaming share of just 25 percent, compared to Amazon Prime's 19 percent, Disney + and Hulu at 13 percent each, and HBO Max at 12 percent.[79]

45. The personal computer (PC) market has also seen dominant firms lose substantial share. The IBM brand was nearly synonymous with the industry for decades. However, competition from other PC makers such as Compaq and Apple Computer dissipated IBM's market share, which fell from 80 percent to 20 percent in the decade between 1982 and 1992.[80] In 2004, IBM sold its personal computer business to Lenovo, which maintained a 24.6 percent worldwide market share in 2021, compared to 21.1 percent for HP, 19.5 percent for Dell, and around 7 percent each for Apple, Acer, and ASUS.[81]

46. Competitive entry in the Internet browser market eroded the market share of Microsoft's Internet Explorer. In 2004, Internet Explorer enjoyed 95 percent market share.[82] By June 2010, its market share had slipped to 53.8 percent, as Firefox (30.6 percent), Apple Safari (6.8 percent), and Google Chrome (5.7 percent) competed for users.[83] Recently, Google Chrome has supplanted Microsoft's browser offering (now called Edge) at the top of the market, with a

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76. *See, e.g.,* James Brumley, *Netflix is Losing Market Share, but This is the Actual Risk to Shareholders*, THE MOTLEY FOOL (Apr. 25, 2021), https://www.fool.com/investing/2021/04/15/netflix-is-losing-market-share-but-thats-not-the-a/ ("Netflix (NFLX -1.73%) is losing market share to be sure -- but consider the circumstances. It was the first company to make streaming video a mainstream phenomenon, and for years, it was the only serious name in the business. It's only natural that the recent launches of big rival services such as Disney's (DIS 0.00%) Disney+ and AT&T's (T 1.73%) HBO Max would chip away at Netflix's share of the on-demand video space.").

77. Nielsen, *The Total Audience Report Q4 2014*, at 5, *available at* nielsen.com/wp-content/uploads/sites/2/2019/04/total-audience-report-q4-2014.pdf (showing 40.3 percent of US TV households with SVOD, and 36 percent of US TV households subscribing to Netflix).

78. Georgina Tzanetos, *Netflix Loses 31% Market Share as Streaming Rivals Gain Loyal Subscribers*, YAHOO!, (April 7, 2021), *available at* https://www.yahoo.com/video/netflix-loses-31-market-share-204537722.html.

79. Joe Wituschek, *Apple TV+ gains market share in the United States while Netflix loses it*, JUSTWATCH (Jan. 24, 2022), *available at* https://www.imore.com/apple-tv-gains-market-share-united-states-while-netflix-loses-it. *See also* Brumley, *supra* ("Data from market intelligence outfit eMarketer lets us fleshes out this trend with some numbers. It reports that Netflix secured 36.2% of the U.S. over-the-top television industry's revenue in 2020, down from 44.4% in 2019. By 2022, its share is expected to be down to 28.4%, and almost even with Disney's slice of the U.S. streaming market.").

80. James W. Cortada, *How the IBM PC Won, Then Lost, the Personal Computer Market - Not even Big Blue could keep up with its creation's success*, IEEE SPECTRUM (July 21, 2021), *available at* https://spectrum.ieee.org/how-the-ibm-pc-won-then-lost-the-personal-computer-market.

81. Gartner Press Release, *Gartner Says Worldwide PC Shipments Declined 5% in Fourth Quarter of 2021 but Grew Nearly 10% for the Year* (Jan. 12, 2022), *available at* https://www.gartner.com/en/newsroom/press-releases/2022-01-12-gartner-says-worldwide-pc-shipments-declined-5-percent-in-fourth-quarter-of-2021-but-grew-nearly-10-percent-for-the-year.

82. TheCounter.com, Browser Stats, April 2004, *archived at* https://web.archive.org/web/20111101195133/http://www.thecounter.com/stats/2004/April/browser.php.

83. AT INTERNET INSTITUTE, *Are we heading towards the end of Internet Explorer's reign in Europe?* (July 27, 2010), *archived at* https://web.archive.org/web/20100806153329/http://www.atinternet-institute.com/en-us/browsers-barometer/browser-barometer-june-2010/index-1-2-3-205.html.

usage share of 65 percent of all browsers, compared to 19 percent for Safari and only 4 percent for Edge.[84]

47. According to Dr. Leonard, none of the industries above are sufficiently similar to the markets at issue here.[85] By Dr. Leonard's standard, no benchmark would ever be suitable, because there will always be differences from one industry to the next.

48. Dr. Leonard's attempts to show that damages are "highly sensitive to economically plausible changes" in market shares[86] are unpersuasive. Despite offering no evidence that the Play Store's but-for market share would have been greater than 60 percent, Dr. Leonard arbitrarily recalculates damages by plugging in ever-higher but-for market share values, offering no explanation for why any of his scenarios are "economically plausible."[87]

49. Moreover, Dr. Leonard purports to demonstrate sensitivity by changing the actual and but-for market shares simultaneously. For example, Dr. Leonard emphasizes that, for my Single Take-Rate Model, "[s]etting the actual share to be 85% and the but-for share 75%... reduces Dr. Singer's damages by 68.5%.[88] This is hardly surprising, as Dr. Leonard is telling the model that Google's share would fall by only ten percentage points, as opposed to the approximately 40 percentage-point decrease that provides the basis for damages. If instead I set Google's actual market share to 85 percent, while maintaining the same proportional decrease in market share, the but-for take rate remains the same for my Single Take-Rate Model.[89] Similarly, if I assume that Google's initial share of the In-App Aftermarket is 85 percent (rather than 97 percent), the change in the but-for take rate is modest.[90]

50. For the In-App Aftermarket, my damages calculations utilize a standard economic framework developed by Landes and Posner (the "Landes-Posner Model").[91] Applied here, the Landes-Posner Model allows me to estimate how Google would respond if, instead of enjoying a monopoly on services in the In-App Aftermarket, it were forced to compete with entrants who would push the market price of these services closer to their marginal cost. Dr. Leonard does not dispute that the Landes-Posner model is standard and well-accepted, or that economists have used it to study industries in which previously dominant firms face competitive entry. Published, peer-reviewed economic studies have employed the Landes-Posner model when the competitive fringe accounted for more than 40 percent or more of the market.[92]

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84. STATCOUNTER GLOBALSTATS, Browser Market Share Worldwide, October 2021, *available at* https://gs.statcounter.com/browser-market-share#monthly-202110-202110-bar.

85. Leonard Report ¶94.

86. Leonard Report ¶97.

87. Leonard Report ¶97.

88. Leonard Report ¶97; Figure 9.

89. In the Single Take-Rate Model, the reduction in the take rate is independent of the initial market share. What matters for modeling purposes is that Google would capture 60 percent of its initial share.

90. If Google's actual market share is 85 percent, a proportional decrease would make its but-for share approximately 53 percent (equal to 0.85*(0.6/0.97)). Under these assumptions, the but-for take rate for my In-App Aftermarket model would be 13.9 percent, instead of the 14.4 percent but-for take rate calculated in my Merits Report.

91. Singer Merits Report ¶¶326-330.

92. Singer Merits Report ¶329 (citing an economic study in which the dominant firm, Alcoa, had a market share of just 35 percent during the relevant time period, with the competitive fringe accounting for the remaining 65 percent).

51. My Merits Report used the standard formula given in the Landes-Posner Model to determine the extent to which Google's own-price elasticity would increase in the but-for world. According to this formula, Google's own-firm elasticity would increase as its market share falls in the but-for world.[93] Consistent with how this formula has been applied in the peer-reviewed economics literature, I held the market elasticity constant while solving for Google's but-for own-firm elasticity.[94] Dr. Leonard attempts to demonstrate that my model is sensitive to the form of the demand curve by arbitrarily imposing linear demand and showing that damages fall by 45 to 50 percent.[95] Dr. Leonard performs no empirical testing of any kind to justify using a linear demand curve. I have performed this analysis, and found that linear demand does not fit the data well.[96] Moreover, as Dr. Leonard concedes, imposing linear demand is tantamount to imposing a much lower pass-through rate (50 percent) than the pass-through rate that I calculated using standard empirical economic methods (91 percent).[97] It is no great surprise that arbitrarily cutting the pass-through rate by about half also reduces damages by about half nor does it undermine my conclusions.

52. My Merits Report explained that although I conservatively allow Google to charge a substantial markup in the but-for world and to retain 60 percent of its prior market share, the remainder of the market would be characterized by competition among providers of homogeneous commodity services, which could be offered by a range of potential rivals with few barriers to entry or expansion.[98] Dr. Leonard asserts incorrectly that the Landes-Posner Model is "not a sound fit" because that model assumes that Google would face just such a market structure in the but-for world, and because I purportedly provide no support for applying the standard Landes-Posner Model of homogenous commodity services competition among the competitive fringe.[99] In fact, my report cites extensive record evidence in support of this market structure,[100] and lists a range of existing rivals that could be potential entrants in a more competitive but-for world.[101] Similarly, Dr. Leonard is incorrect to claim that the econometric estimate of the supply elasticity for AT&T's long-distance competitors that I employed in my Merits Report[102] is inapplicable because AT&T faced a "considerably fragmented set of individually relatively small competitors," and because

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93. As seen in Table 8 of the Singer Report, Google's own-firm demand elasticity would increase from approximately [redacted] in the actual world to [redacted] in the but-for world. Singer Merits Report Table 8, Rows [9], [14].

94. *See* Singer Merits Report ¶¶328-329 and literature cited therein.

95. Leonard Report ¶¶98-100.

96. As shown in Appendix 3, linear demand does not fit the data well. Contrary to economics, the price coefficients are statistically insignificant in 12 out of the 33 regressions.

97. Leonard Report ¶100 ("With a linear demand curve, the pass-through rate is 50%[.]").

98. Singer Merits Report ¶¶322-326.

99. Leonard Report ¶¶106-107.

100. Singer Merits Report ¶¶322-326.

101. Tables 9 – 10 of my Merits Report list a range of potential rivals, including Paddle, PayPal, Stripe, Amazon Pay, Square, and many others. Dr. Leonard claims that two of these potential rivals (PayPal and Stripe) are not suitable benchmarks because "PayPal holds a market share by the number of transactions of 54% in the online payment processing market, and Stripe holds a market share of 19%." Leonard Report ¶103. I have seen no evidence that PayPal or Stripe have significant market power in their existing markets, which implies that their market shares are maintained by competitive pricing. Moreover, these existing markets are distinct from the In-App Aftermarket. Dr. Leonard provides no evidence that there would be barriers to entry in the In-App Aftermarket, or that services in the In-App aftermarket would not be homogenous, or that the number of potential entrants would be limited.

102. Singer Merits Report ¶332.

long-distance service is relatively homogenous.[103] Dr. Leonard ignores that AT&T faced long-distance fringe rivals such as MCI and Sprint, which had significant market shares, yet the Landes-Posner Model was still applicable to the industry.[104] Similarly, there are a large number of potential entrants in the In-App Aftermarket, which would provide homogeneous commodity services.

53. Dr. Leonard claims incorrectly this market structure is inconsistent with the fact that my analysis of a potential but-for world requires entry by only one viable rival App store.[105] This critique confuses but-for competition in the Android App Distribution Market (which, for such competition to drive down prices, could involve only one rival App store, or a handful of rival App stores, offering matchmaking services in competition with the Play Store) with but-for competition in the In-App Aftermarket (which would be characterized by competition to provide homogeneous services). My economic models account for this difference by assuming that Google faces an inelastic supply response from its rival(s) in the Android App Distribution Market,[106] and an elastic supply response in the In-App Aftermarket.[107]

C. Dr. Leonard's Critiques of My Direct Consumer Discount Model Are Without Merit

54. In competitive markets, two-sided platforms frequently compete by offering direct discounts to consumers. Google offers limited consumer discounts even today ([redacted]), and the Amazon Appstore offers far more generous discounts ([redacted]) on Google Android devices. In my Merits Report, I calculated overcharges to the Consumer Class by estimating the extent to which Google would have offered more generous consumer discounts, resulting in lower net prices.[108] The damages calculated from these models are simply consumer overcharges viewed from the consumer side of the platform. Specifically, my two-sided Discount Model calculates damages using a two-sided market model in which competition occurs over customer discounts, instead of the take rate. My Amazon Discount Model calculates damages based on the discounts that Amazon provides to customers accessing the Amazon Appstore via Google Android devices.

55. Dr. Leonard has no new critiques of my two-sided Discount Model beyond the critiques of the Rochet-Tirole model addressed above. With respect to Amazon Discount Damages, Dr. Leonard offers no alternative damages calculations or other quantitative critiques. Dr. Leonard does claim that "Amazon Coins operates in a fundamentally different way than

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103. Leonard Report ¶102.

104. Simran Kahai, David Kaserman & John Mayo, *Is the "Dominant Firm" Dominant? An Empirical Analysis of AT&T's Market Power*, 39 JOURNAL OF LAW & ECONOMICS 499, 503 (1996) ("AT&T's two largest competitors, MCI and Sprint, have grown considerably. At the beginning of the sample period, the revenue-based market shares of these two firms were 5.5 and 2.6 percent, respectively. In 1988, these market shares were 10.3 and 7.2 percent, and by 1993 they had grown to 17.8 and 10.0.").

105. Leonard Report ¶107.

106. Singer Merits Report ¶304, n. 686.

107. Singer Merits Report ¶332.

108. In footnote 141 of his report, Dr. Leonard suggests that developers might increase their App prices in response to greater consumer subsidies. I have seen no evidence that developers have done so in response to Google's Play Points subsidies, or in response to the Amazon Coin subsidies. This "reverse pass-through" claim is at odds with record evidence cited in my Merits Report showing the success of consumer subsidies in Japan and Korea. Singer Merits Report ¶¶374-377. Consumer subsidies would not be effective in attracting consumers if they subsidies were offset by higher prices, as Dr. Leonard claims.

Google Play Points;"[109] he observes that Amazon Coins requires a minimum purchase (of $3), cannot be converted back into cash, offers lower discounts on lower purchase volumes, cannot be used "to buy in-app subscriptions," and cannot be "used together with cash or other forms of payment."[110] Dr. Leonard ignores that my Amazon Discount Damages account for such factors because they are based on the discounts actually redeemed by consumers in the Amazon Appstore, according to Amazon's own data.

56. Moreover, my Amazon Discount Damages do not assume that Google would adopt an identical consumer subsidy mechanism in a more competitive but-for world; the calculations assume only that Amazon's aggregate discounts provide a reliable estimate of the aggregate discounts that consumers could expect to receive in a more competitive but-for world. The Amazon Discount Damages provide a metric for the kinds of discounts that Google would have had to match if it faced real competition.

57. Dr. Leonard claims that I offer no evidence as to "why the consumer demand, costs, business strategy, and competition for the Amazon Appstore on third party devices in the actual world would be similar to that of Google Play in the but-for world[.]"[111] But as I explained in my Merits Report, there is sound economic justification underlying the notion that Amazon's aggregate discounts in the actual world provide a reliable estimate for the Play Store's aggregate discounts in a more competitive but-for world: The Amazon Appstore participates in Android App Distribution Market; like the Play Store, the Amazon Appstore is available on third-party smartphones and tablets that Amazon does not own. The key difference between them is that the Amazon Appstore is not dominant in the Android App Distribution Market and is obliged to compete on the merits. Amazon has chosen to compete by offering generous consumer subsidies, and according to Amazon's own documents, these generous consumer subsidies have been the most effective competitive strategy for the Amazon Appstore on third-party devices.[112]

D. The Claims of Dr. Leonard and the Other Google Experts Regarding Markets In China Do Not Undermine my Conclusions

58. Dr. Leonard presents China as a "Comprehensive Benchmark for the But-For World," and claims, based on the Chinese experience, that Class Members would be worse off in the but-for world.[113] Dr. Gentzkow makes similar claims.[114] For example, Dr. Gentzkow claims that the Chinese Android ecosystem is a "vivid illustration of what a world without Google's current conduct might look like,"[115] and goes on to detail "severe fragmentation"[116] in China without considering whether these problems might be caused by other aspects of the economic environment in China.

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109. Leonard Report ¶111.
110. Leonard Report ¶111.
111. Leonard Report ¶112.
112. Singer Merits Report ¶115.
113. Leonard Report ¶169; ¶¶179-83.
114. Gentzkow Report ¶¶641-643.
115. Gentzkow Report ¶641.
116. Gentzkow Report ¶642.

59. The Google Experts fail to identify a more basic likely cause of the fragmented nature of app stores in China: limited intellectual property protections and widespread app scraping. Record evidence indicates that in China it is a common practice for app stores to scrape apps from competing stores and publish those apps without developers' consent. According to a Google presentation cited by Dr. Gentzkow, Chinese app stores "scrape other stores for apps (and updates)," and as a result, "once you publish a newer version of your app to a store, you lose a lot of control over how / where users actually get that app."[117] This evidence is consistent with broader evidence of software piracy in China.[118] Lacking the ability to choose which app stores do and do not list their apps, it is common in China for app developers to acquiesce and attempt to earn revenue from app stores that scrape their apps by contacting those app stores and claiming the app as their own.[119]

60. The proliferation of app stores in China may therefore be attributable to the fact that app developers have no ability to choose to congregate in a smaller number of well-run stores. It may also explain the higher rates of malware in China highlighted by the Google Experts: If Chinese App developers had better control over where their apps were listed, they would have reputational economic incentives not to list their apps in venues prone to malware or other security risks.

61. The prevalence of app scraping may also explain the higher prevailing take rates on some Chinese app stores highlighted by the Google Experts. It would be economically rational for developers in the Chinese market to accept higher take rates on App stores that can offer protection against the general lack of robust property rights for their Apps, including the risks of piracy and malware. Put another way, developers would rationally pay higher take rates to purchase insurance against the risk of having their intellectual property appropriated—from the developer's perspective, a take rate of 50 percent is better than a take rate of 100 percent.

62. Higher prevailing take rates among some app stores in China may also be attributed to costly monitoring apparatuses they are required to set up to assist in Government oversight and censorship, and the liability risks stores face for regulatory failures. Chinese app stores are regulated by the Chinese Ministry of Industry and Information Technology (MIIT), the agency that regulates telecommunications providers.[120] I understand that the MIIT requires that app stores hold an "Internet Content Provider" (ICP) license, a license that has historically required its holder "to prevent the appearance of politically objectionable content through automated means, or to police content being uploaded by users for unacceptable material," and license holders risk being "held liable for all content appearing on their websites," including content created by "users of its . . . sharing services."[121] This cooperation with Chinese censors imposes significant costs on app

117. GOOG-PLAY-000272539.R at –578.R.

118. As of 2017, approximately 70% of computers in China were running pirated versions of software—the highest rate reported among large countries. *See* U.S. News, "China Has a Fondness for Pirated Software" (May 16, 2017), https://www.usnews.com/news/business/articles/2017-05-16/chinas-fondness-for-pirated-software-raises-risks-in-attack.

119. GOOG-PLAY-000272539.R at –583.R-584.R.

120. Simmons + Simmons, "China strengthens regulation of app stores" (Feb. 13, 2017), https://www.simmons-simmons.com/en/publications/ck0bdr12qo3bz0b33nekzx642/13-china-strengthens-regulation-of-app-stores.

121. Human Rights Watch, "Race to the Bottom: Corporate Complicity in Chinese Internet Censorship" (Aug. 9, 2006), https://www.hrw.org/report/2006/08/09/race-bottom/corporate-complicity-chinese-internet-censorship.

stores. For instance, all Chinese mobile games must go through a content review by the National Press and Publication Administration, and app stores must "set up convenient methods for reporting and recording complaints, and promptly handle these complaints and reports."[122] If app stores fail to satisfy these obligations, they "can be held liable for content posted and spread by their users, especially if they did not have effective auditing systems in place to help prevent it."[123]

63. China has also increased the regulatory burden on app stores in recent years. In June 2016, the Cyberspace Administration of China (CAC) issued new rules for app stores.[124] These rules allocated responsibility for much of the government's oversight of apps to app stores themselves, including storing a "vast amount of personal data" required under China's "real name registration" rules, and issuing warnings and suspending app developers who fail to comply with state regulations.[125] The CAC further required that Chinese app stores "conduct an authenticity, security and legality review of the app developers whose apps are made available in their stores."[126] I understand that app stores in China can be held liable for violations by the apps they list.[127]

64. The need to monitor individual apps, and the risk of liability from any given app, implies that the regulatory costs incurred by Chinese app stores are to a significant extent variable costs that grow with the size of the platform. As a result, Chinese app stores would be expected to recoup pass on these costs in the form of higher take rates on developers.

E. Dr. Leonard's Remaining Critiques Are Without Merit

65. In my Merits Report, my logit regressions were structured around App categories used by Google, developers, and consumers. The evidence shows that App categories consist of economically reasonable groupings of consumer tastes for different varieties of Apps, as recognized by a range of industry participants, including Google. The Play Store's categories are used by industry analysts. Developers, who presumably know their customers best, use Google's categories to sell their Apps in competition with other developers; they have clear incentives to select a meaningful category to maximize the value of their Apps. The evidence also shows that the Play Store's categories are economically meaningful to consumers, given their prominent

122. AppInChina, "Making Your Mobile App or Game Compliant With Chinese Law", https://www.appinchina.co/services/localization/compliance/.

123. *Id.*

124. Norton Rose Fulbright, "China issues new rules to tighten regulation of Mobile Apps market" (July 2016), https://www.nortonrosefulbright.com/en/knowledge/publications/93003105/china-issues-new-rules-to-tighten-regulation-of-mobile-apps-market.

125. *Id.*

126. Simmons + Simmons, "China strengthens regulation of app stores", (Feb. 13, 2017), https://www.simmons-simmons.com/en/publications/ck0bdr12qo3bz0b33nekzx642/13-china-strengthens-regulation-of-app-stores (explaining that the CAC requires "[a]pp store operators" to "conduct an authenticity, security and legality review of the app developers whose apps are made available in their stores").

127. AppInChina, "Making Your Mobile App or Game Compliant With Chinese Law," https://www.appinchina.co/services/localization/compliance/ ("Overall, these [Chinese] regulations make it clear that app stores can be held liable for the infringements of the apps on their stores. So think of the app store as your partner, making sure you are complying with local laws. They will audit your app for issues and request the appropriate documents to prove your company is legally registered and able to publish an app in China.")

display within the Play Store and given that consumers can filter the Apps displayed to them based on the Play Store categories. In addition, Apple's App Store uses a similar set of categories.[128]

66. Dr. Leonard does not dispute any of the evidence supporting my use of App categories but claims incorrectly that "the fact that these categories are used by Google and analysts does not justify their validity or relevance for informing the specific economic question of service rate pass-through."[129] Dr. Leonard does not provide any economic literature or authority to support this incorrect claim, but instead points to cherry-picked examples of Apps that he deems unfit to be classified in the same category, because they don't seem similar enough to him.[130] As I explained in my Merits Report, the logit model allows for differentiation of Apps within a given category.[131] Indeed, it is standard to apply the logit model to markets with differentiated products.[132]

67. Dr. Leonard claims mistakenly that I "considered putting Tinder in both the Lifestyle category and the Dating category and estimated a pass-through rate of [redacted] for the former and [redacted] for the latter."[133] In fact, recategorizing Tinder from "Lifestyle" to "Dating" has a modest effect on Tinder's estimated pass-through rate (increasing it from [redacted] to [redacted]).[134] The "Tinder" App is categorized under the "Lifestyle" category in both the Apple App Store and the Play Store.[135]

68. In Exhibit 17 of his report, Dr. Leonard presents a "Summary of Selected Online Platform Service Fees With Service Fee Rates At or Above 30%." Dr. Leonard relies on many of the same unsuitable benchmarks (such as PlayStation, Nintendo, and Kindle Direct Publishing) as the other Google Experts. In Appendix 5, I review the various benchmarks offered by each of the Google Experts and I explain why they are unpersuasive.

69. Dr. Leonard suggests incorrectly that developers' incentives to steer would not put downward pressure on take rates in a more competitive but-for world.[136] According to Dr. Leonard, "nothing prevents a developer advertising lower prices outside Google Play, reaching users through social media or online forums...."[137] Dr. Leonard fails to recognize that, as I explained in my Merits Report, it is the combination of multi-homing *and* steering that would provide (one of

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128. Singer Merits Report ¶¶349-351.
129. Leonard Report ¶66.
130. Leonard Report ¶66.
131. Singer Merits Report ¶351 ("The logit demand model also does not imply that all products in the market are perfectly interchangeable, but instead allows for product differentiation.")
132. Singer Merits Report ¶351, n. 825, citing Gregory Werden & Luke Froeb, *The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy* 10(2) JOURNAL OF LAW, ECONOMICS, & ORGANIZATION 407, 408 (1994) ("the logit model has direct policy relevance, since the 1992 Horizontal Merger Guidelines use it as the base case for the analysis of mergers in differentiated products industries.")
133. Singer Merits Report ¶351, n. 825, citing Gregory Werden & Luke Froeb, *The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy* 10(2) JOURNAL OF LAW, ECONOMICS, & ORGANIZATION 407, 408 (1994) ("the logit model has direct policy relevance, since the 1992 Horizontal Merger Guidelines use it as the base case for the analysis of mergers in differentiated products industries.")
134. Singer Merits Report ¶360, n. 851.
135. Singer Merits Report ¶360, n. 851.
136. Leonard Report ¶83.
137. Leonard Report ¶83.

the) economic incentives for developers to share cost savings with consumers in the but-for world.[138] For this competitive mechanism to work, there must be robust competition in the Android App Distribution market, which is absent in the actual world. Moreover, as I explained in my Merits Report, a few developers with critical mass of consumers and widespread name recognition (such as Spotify and Netflix), have, in fact, engaged in indirect steering, through communications outside the App. In a more competitive but-for world, these steering incentives would be much more widespread.

70. Dr. Leonard claims that "Google did not change its service fee rate when rival platform ONE Store entered (in South Korea) and…developers do not tend to offer lower-priced apps on ONE Store, even though ONE Store offers a lower service fee."[139] But the ONE Store offers only localized competition, whereas many developers (particularly the largest and most economically significant ones) operate globally. It makes economic sense that Google would not respond to localized competition by decreasing its global take rate. Instead, as I explained in my Merits Report, Google has responded to competition from the ONE Store by increasing its direct consumer subsidies to Korean users, thereby decreasing the total cost of the platform in a manner that directly benefits consumers.[140] Record evidence indicates that the One Store, too, has offered substantial consumer discounts, including "refunds of 30 to 50 percent on total transactions inside certain gaming apps."[141] This evidence indicates that the limited, localized competition in Korea has focused on direct consumer discounts, rather than lower take rates and steering.

71. Dr. Leonard claims that developers that would have multi-homed in the but-for world would have incurred additional costs associated with developing and deploying apps to competing App stores.[142] As an economic matter, a competing App store would have clear economic incentives to minimize any incremental costs that developers might incur to list their Apps in that App store. In addition, I understand that Professor Schmidt has found that the technical requirements associated with developing Apps to function in multiple stores are modest. Of course, a large number of developers already deploy their Apps to two stores—the Play Store and the Apple App Store.

72. Dr. Leonard claims that consumers would incur additional search costs in the but-for world because "consumers would have had to spend more time searching to identify the set of apps to download to their phones."[143] Dr. Leonard provides no compelling evidence that increased competition in the Android App Distribution market would significantly increase consumer search costs. As Dr. Gentzkow emphasizes, a competing App store can be "literally a click away."[144] In a more competitive but-for world, competing App stores would face clear economic incentives to minimize the any consumer costs of multi-homing.

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138. Signer Merits Report Part VI.A.
139. Leonard Report ¶84.
140. Singer Merits Report ¶377.
141. Korea JoongAng Daily, "One Store gains ground in local Android app market", (December 2, 2020), https://koreajoongangdaily.joins.com/2020/12/02/business/industry/One-Store-app-market-Google/20201202175300439.html.
142. Leonard Report ¶161.
143. Leonard Report ¶159.
144. Gentzkow Report ¶31.

II. Dr. Gentzkow Fails to Undermine My Conclusions

73. My Merits Report applied standard antitrust economics to demonstrate that Google has maintained monopoly power in the Android App Distribution Market and in the In-App Aftermarket, and that Google's anticompetitive conduct has resulted in antitrust injury to the Consumer Class. In the Android App Distribution Market, the Challenged Conduct has allowed Google to deny its rivals access to critical inputs necessary to compete effectively. This includes contracts restricting rivals' ability to successfully preload their App stores on Consumers' devices and secure exclusive content,[145] and technical barriers restricting alternative distribution methods.[146] Google also made payments to wireless carriers that disincentivized them from competing in App distribution.[147] In addition to keeping wireless carriers largely out of the Android App Distribution Market, these payments impaired competition from other would-be rival App stores, given that wireless carriers controlled which App stores were preloaded on devices and no equally efficient competitor could profitably match Google's predatory discounts.[148] I also showed that the In-App Aftermarket Tie-In substantially foreclosed competition by excluding rivals from the In-App Aftermarket, preventing the vast majority of developers from switching to a competing In-App Aftermarket rival (or credibly threatening to switch) in exchange for a lower, more competitive take rate.[149] The In-App Aftermarket Tie-In also reinforces foreclosure in the Android App Distribution Market by preventing would-be rivals from expanding from one market to another.[150]

74. As I explain below, Dr. Gentzkow does not engage with the collective effect of Google's anticompetitive restrictions on potential competitors. Instead, he attempts to justify individual elements of the Challenged Conduct on procompetitive grounds in isolation. Below I explain why Dr. Gentzkow's efforts to defend each of these components of the Challenged Conduct are unpersuasive and do not undermine my conclusions.

75. I also explain that Dr. Gentzkow's critiques of my analysis are almost entirely removed from standard antitrust economics. For example, Dr. Gentzkow assumes anticompetitive foreclosure cannot have occurred as long as consumers and developers have "access" to virtually any "alternative" to the Play Store, no matter how remote, inferior, or inefficient these alternative distribution channels may be. To the extent that he engages with the empirical evidence, Dr. Gentzkow champions standards for antitrust immunity so lenient that they would be satisfied under virtually any fact pattern. For example, economists have observed for decades that output and product quality have increased over time in a wide range of high-tech markets, driven by progress in the underlying technologies.[151] Dr. Gentzkow observes similar patterns in this case, he treats it

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145. Singer Merits Report Part IV.A.
146. Singer Merits Report Part IV.A.4.
147. Singer Merits Report Part IV.A.1.
148. Singer Merits Report ¶¶190-191.
149. Singer Merits Report Part V.B.
150. Singer Merits Report ¶249.
151. *See, e.g.,* Ernst Berndt & Neal Rappaport, *Price and Quality of Desktop and Mobile Personal Computers: A Quarter- Century Historical Overview* 91(2) AMERICAN ECONOMIC REVIEW 268 (2001).

as if it were definitive evidence that the Challenged Conduct is procompetitive. Dr. Gentzkow also ignores or minimizes the anticompetitive potential of multi-sided tech platforms.[152]

A. Dr. Gentzkow Does Not Demonstrate That Google Lacked Monopoly Power in the Relevant Antitrust Markets At Issue During the Class Period

76. In my Merits Report, I used standard methods routinely employed by antitrust economists to demonstrate that Google has monopoly power in the market for licensed mobile operating systems,[153] in the Android App Distribution Market,[154] and in the In-App Aftermarket.[155] The economic evidence demonstrates Google's monopoly power through direct methods, given Google's proven ability to exclude rivals and to raise prices above competitive levels.[156] Google's monopoly power is also revealed through indirect evidence, using standard metrics such as Google's consistently dominant market shares in the relevant markets at issue.[157]

77. Dr. Gentzkow does not dispute my definition of the relevant antitrust markets at issue,[158] nor does he dispute much of the clear evidence that Google has maintained dominant market shares in each of these relevant markets.[159] In Exhibit 1 of his report, Dr. Gentzkow presents data confirming that the Android OS has accounted for the vast majority of the market for licensable mobile operating systems. To illustrate, Figure 5 below displays data from the same source, excluding feature phones, which are outside the relevant market.

152.*See, e.g.,* Susan Athey & Fiona Scott Morton, Platform Annexation 84 ANTITRUST LAW JOURNAL (2022) 677, 696-697 [hereafter, Athey & Scott Morton (2022)]; *see also* Jonathan Baker & Fiona Scott Morton, *Antitrust Enforcement Against Platform MFNs,* 127(7) YALE LAW JOURNAL 2176-2202, 2177 (2017); *Investigation of Competition in Digital Markets: Majority Staff Report and Recommendations*, H.R. Subcomm. on Antitrust, Commercial and Administrative Law of the Comm. on the Judiciary.

153.Singer Merits Report Part I.

154.Singer Merits Report Part II.

155.Singer Merits Report Part III.

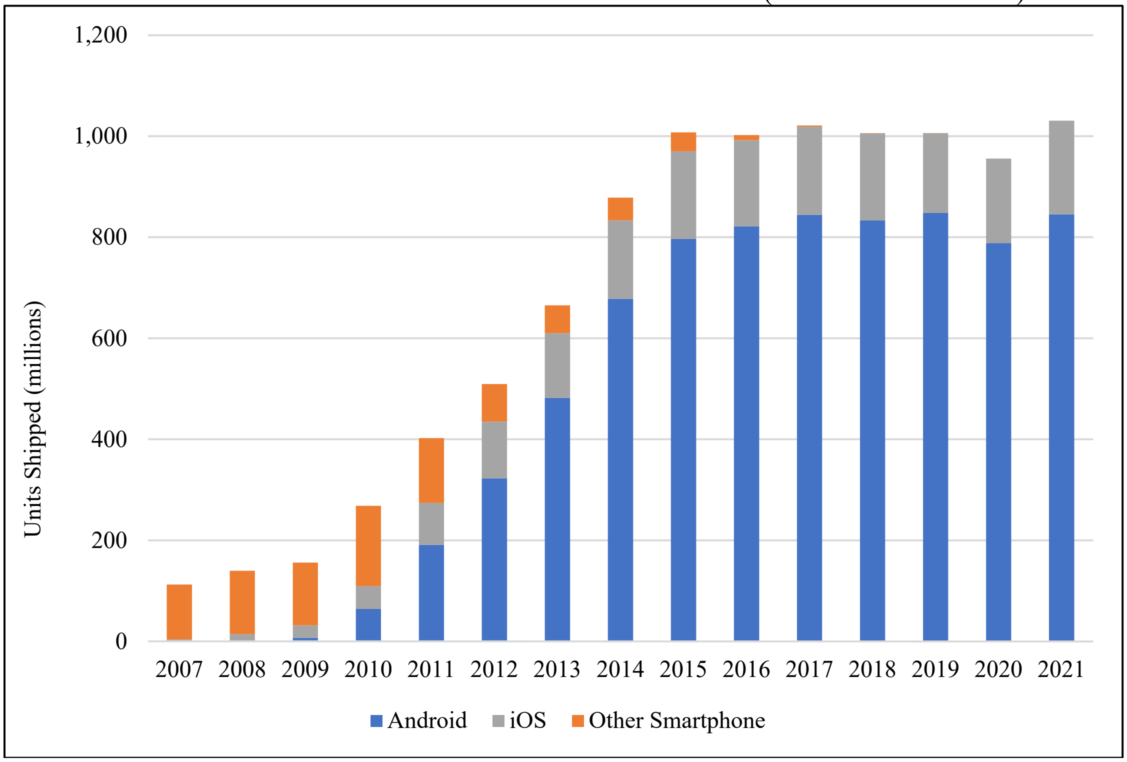
156.Singer Merits Report Parts I.C.1; II.C.1; III.C.1.

157.Singer Merits Report Parts I.C.2; II.C.2; III.C.2.

158.Gentzkow Report ¶177 ("[A]nalyzing market definition is outside the scope of my assignment[.]")

159.For example, Dr. Gentzkow presents data confirming that Android accounts for the vast majority of U.S. smartphone sales with licensable software going back at least ten years. Gentzkow Report Appendix C, Exhibit C1.

FIGURE 5: WORLDWIDE SMARTPHONE SALES BY OS (EXCLUDING CHINA)



Sources: IDC Data. Excluded feature phones.

78. Dr. Gentzkow does not even directly dispute that Google has had monopoly power throughout the Class Period. For example, Dr. Gentzkow singles out November 2008 (a month after Android's launch) as a time when the Play Store "could not plausibly have had significant market power,"[160] but does not make this claim for the Class Period, when Google clearly possessed market power under any reasonable application of standard antitrust methods. Dr. Gentzkow assumes all evidence of severe rival impairment is solely attributable to what he deems Google's successful "competition on the merits,"[161] without directly disputing the fact that Google has market power (however acquired).

79. Dr. Gentzkow asserts incorrectly that I opined that Google lacked the requisite market power to impose anticompetitive contracts in the Android App Distribution Market during the early years (2008-2009)[162]—a time period when the Android App Distribution Market barely existed.[163] That is not my opinion. Google had an incumbency advantage at the outset of the Android App Distribution Market due to its licensing of the Android operating system and its well-

160. Gentzkow Report ¶510.

161. Gentzkow Report ¶¶229-242.

162. Gentzkow Report ¶36. *Id.* ¶292 (characterizing 2009 as a time when "Android and Android Market were new entrants" lacking monopoly power). *Id.* at ¶510 (characterizing November 6, 2008, "roughly two weeks after the launch of Android Market" as "a time when [Google] could not plausibly have had significant market power.").

163. The Android App Distribution Market came into existence between 2008 to 2009. The In-App Aftermarket did not exist until in or around 2011. *See, e.g.,* Consumer Class Plaintiff's First Supplemental Objections and Responses to Defendants' Third Set of Interrogatories, Response No. 20.

established dominance in search and other mobile functionality such as Google Maps.[164] This incumbency advantage also applied to the licensable mobile OS market, because it gave OEMs clear incentives to enter into MADAs with Google.[165] Dr. Gentzkow also fails to recognize the elementary economic principle reflected in my analysis of Google's early RSAs—that coordination with actual or potential horizontal rivals confers additional market power.[166] In this case, Google used early forms of the Challenged Conduct, such as RSAs with wireless carriers, to extend and enhance its market power by allowing it to ward off competitive entry and expansion by would-be horizontal rivals just as the Android App Distribution Market was starting to take shape.[167]

B. Dr. Gentzkow Fails To Demonstrate the Challenged Conduct Is Procompetitive

80. In this Section, I address Dr. Gentzkow's claims with respect to each element of the Challenged Conduct. As detailed below, Dr. Gentzkow ignores standard antitrust principles, relies on incorrect assumptions, and fails to demonstrate that the Challenged Conduct was necessary to achieve the purported benefits claimed by Dr. Gentzkow. In addition, Dr. Gentzkow's element-by-element approach ignores the coordinated nature and effects of the Challenged Conduct, as I explain in Part II.C.2 below.

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164. Singer Merits Report ¶184 (explaining that Google's strategy included extending its power from search and the associated advertisements into adjacent markets such as app distribution). As I testified, "Google *already had the incumbency advantage*, and it was worried that a mobile operator would invade its space or support a rival app store. And so, it decided to basically to bribe the -- the -- the mobile carriers and did it in a way that caused Google to incur a loss…It incurred a loss in the actual world by virtue of the revenue-sharing agreements, which is what made those agreements anticompetitive." Deposition of Hal Singer, PhD (May 12, 2022) [hereafter, Singer Dep.] 271:10-24 (emphasis added). *See also* GOOG-PLAY4-000804641 at -643 (explaining that mobile search "is also crucial in gaining access to users through the Carrier channel (whether through deals with Operators/Carriers - 'push' to consumer - or by creating consumer pull)."); GOOG-PLAY4-000301527 at -549 (identifying one of Google's "2009 Sales Goals" for mobile as "OEMs: maximizing shipments and transition/up-sell to pure Google experience based on new search and apps product offerings when available"); GOOG-PLAY-004456799 at -7117 (draft text of book on the history of Android by Google employee Chet Hasse explaining, "If partner companies wanted to ship a device with Android, including Google applications and services, they had to sign the AFA. Google applications and services were the incentive for these companies. ").

165. Singer Dep. 363:14-364:3 ("Q. And why do the OEMs agree to the MADA? A. I think that Google holds a lot of the leverage in those negotiations. I think that if they don't go to the MADA, which is -- I understand is an all-or-nothing offer, that you'd have to take the entire suite, it's going to be hard to sell a phone…Google is holding some very valuable properties, Maps, Search tools…"); Singer Merits Report ¶195 ("OEMs must sign a MADA with Google to obtain the entire suite of GMS Apps."). Earlier MADAs defined the applications simply as "Google Applications." *Id.* ¶194, n. 452 (citing GOOG-PLAY-000620996 § 1.1 (2011 Archos S.A. MADA)). MADAs from 2009 contain similar language; *see, e.g.,* GOOG-PLAY-000621061-074 (ASUS), GOOG-PLAY-001388416-429 (HTC), GOOG-PLAY-001745969-981 (Huawei), GOOG-PLAY-000621075-084 (Kyocera), GOOG-PLAY-000621177-189 (LG), GOOG-PLAY-001090012-027 (Motorola), GOOG-PLAY-001388750-763 (Samsung), GOOG-PLAY-000621139-148 (ZTE).

166. *See, e.g.,* N. GREGORY MANKIW, PRINCIPLES OF MICROECONOMICS 337-342 (Cengage Learning 8th ed. 2018) [hereafter MANKIW]. *See also* Department of Justice & Federal Trade Commission, *Horizontal Merger Guidelines* (2010), §2.1 ("Lessening of Competition Through Coordinated Interaction.")

167. Singer Merits Report ¶¶180-189.

1. Dr. Gentzkow Fails to Demonstrate that the Restrictions on Creating Even One Non-Google Version of Android in the AFA Are Procompetitive

81. In my Merits Report, I explained that, although Android is nominally "open-source" software, Google's AFAs (now ACCs) prevented OEMs from selling any Android-based devices that did not meet Google's compatibility standards—a "forked" device. OEMs have been effectively prohibited from responding to an exercise in Google Android's market power by developing a new Android-based OS or by licensing another Android-based OS, such as Amazon's Fire OS.[168] Google's AFA contracts forbade OEMs from distributing even a single forked Android device until 2017.[169] Until 2017, OEMs had to enter into both an AFA and a MADA in order to get access to critical APIs necessary for applications to work. Since 2017, when Google changed the AFA to ACC, OEMs have had to enter into both an ACC and a MADA to gain access to GMS, which has become critical for many Apps to function.[170] Accordingly, the early AFAs worked in concert with other elements of the Challenged Conduct to entrench Google's monopoly in the market for licensable mobile OSs.

82. Dr. Gentzkow claims that Google's ACCs (and AFAs) "enhance the value of the Android ecosystem by aligning the incentives of OEMs to limit fragmentation and to deliver a consistent and high-quality out-of-the-box experience to users."[171] But Dr. Gentzkow does not explain why it is procompetitive for Google to prevent OEMs from manufacturing even a single forked device, as Google did in the critical years when its version of Android was solidifying its power. For example, a successful Amazon phone built on an Android fork might have supplanted Google's near-total monopoly in the market for licensable mobile OSs.[172] OEMs manufacturing devices for both OSs would have clear economic incentives to make their devices cross-compatible with both OSs, and consumers could be offered a choice of operating system when purchasing a device. Dr. Gentzkow provides no credible evidence that having two (rather than one) licensable mobile OSs available to OEMs, consumers, and developers would result in chaotic fragmentation. Nor would a forked device "weaken the associations consumers have with the Android brand."[173] As Dr. Gentzkow observes, Google licenses the Android brand as part of the MADA, so that only Google Android devices are sold as "Android" devices.[174] A forked device would compete under a separate operating system, distinct from Google Android. Dr. Gentzkow also ignores that an OEM faces clear economic incentives to provide the best possible customer experience and would not rationally encumber its devices (or consumers) with a low-quality mobile OS that would harm its own profitability.

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168. Singer Merits Report ¶¶17-18; ¶¶60-61; ¶¶192-193.

169. *See* GOOG-PLAY4-007852650 at -651 (email to Acer representative explaining that the ACC was "a new agreement that will replace your existing AFA" and that it would include a "carveout for production of non-company branded devices").

170. Singer Merits Report ¶193.

171. Gentzkow Report ¶248.

172. Without a successful "Fire Phone," Amazon was less likely to fully compete in the Android App Distribution Market by investing and developing a mobile App store that would rival the Play Store in scope and reach. Singer Merits Report ¶198.

173. Gentzkow Report ¶130.

174. Gentzkow Report ¶ 265 & n. 379.

83. Dr. Gentzkow also claims that, because Google introduced the AFAs in 2008, they could not have reflected the exercise of Google's monopoly power. I have responded to this claim in Part II.A above.

2. Dr. Gentzkow Fails to Demonstrate that the MADAs Are Procompetitive

84. In my Merits Report, I explained that Google's MADAs require distribution and prominent placement of the Play Store by obliging OEMs to pre-install all of the GMS suite (Google Search, Play Store, Maps, Chrome, Gmail, and YouTube) or none of it. OEMs must also sign a MADA in order to access critical APIs so that applications can work. Although the MADAs do not prevent OEMs from preloading alternative App stores, they require the OEMs to load the Play Store on the default home screen.[175] They leverage Google's market power in the GMS suite to ensure that the Play Store will always appear on the default home screen, making it impossible for rivals to displace the Play Store. Dr. Gentzkow disputes that the MADAs actually require the Play Store to receive more prominent placement than other App stores.[176] However, Dr. Gentzkow does not dispute my conclusion, well-established in the behavioral economics literature (and substantiated in Google's documents), that the way in which choices are presented to consumers can significantly influence consumer behavior.[177] Because OEMs must distribute the Play Store on the default home screen, the MADAs effectively secure for the Play Store a prominent position across every single GMS device.

85. Dr. Gentzkow claims that I "suggest[] that OEMS are 'required to sign [MADA] contracts," and claims that "no OEM is required to sign a MADA."[178] Although an OEM could theoretically refuse to sign a MADA, virtually every manufacturer of an Android mobile device worldwide (excluding China) agrees to a MADA out of economic necessity. Doing so is necessary to gain access both to GMS and to APIs that are critical for a great majority of Android Apps to function; Google's migration of key APIs into GMS has effectively ensured that OEMs will agree to the MADA to have a functioning Android mobile device.[179] Dr. Gentzkow's report presents compelling evidence that Huawei's inability to enter into a MADA (due to U.S. government restrictions) crippled its smartphone business outside of China.[180] The Huawei example relied upon

175.Singer Merits Report ¶¶194-197.

176.*See, e.g.,* Gentzkow Report ¶273. I understand that the question of whether the MADAs actually required the Play Store to receive more prominent placement than other App stores is ultimately a dispute to be resolved by the fact finder, and not the experts.

177.Singer Merits Report ¶20; ¶¶196-197. *See also* Comscore, *The 2016 U.S. Mobile App Report*, slide 38, https://www.comscore.com/Insights/Presentations-and-Whitepapers/2016/The-2016-US-Mobile-App-Report, (documenting a "strong correlation between home screen position and how often an app gets used").

178. Gentzkow Report ¶273.

179. Schmidt Report ¶ 39 ("With its inclusion of GMS, Google has effectively created an entirely new platform that is incompatible with AOSP."). GOOG-PLAY-000128863.R at 876.R (2019 Google presentation noting that "826 of the top 1000 Android apps used 1 or more GMS Core APIs").

180. Gentzkow Report ¶277. As a research report cited by Dr. Gentzkow explains, "Huawei told us that its smartphone sales revenue dropped [materially for both smartphones and tablets] between 2019 and 2020. According to Huawei, this was primarily attributable to the lack of availability of apps that rely on Google Mobile Services on newer models of Huawei smartphones and tablets – these apps were not available as from May 2019 Google Mobile Services could not be pre-loaded on these Huawei devices nor downloaded after purchase." *Mobile Ecosystems: Market Study Interim Report*, Competition and Markets Authority, ¶3.177 (Dec. 14, 2021),

by Dr. Gentzkow demonstrates that OEMs have no economically viable alternative but to license GMS and preload it on their Android phones.

86. Dr. Gentzkow claims that the MADA "provides OEMs incentives to guarantee a clean, consistent, and high-quality out-of-the-box experience for users, thereby strengthening the Android brand."[181] But OEMs, whose profits depend critically on users' willingness to pay for the device in the box, have clear economic incentives to provide users with a high-quality experience. Dr. Gentzkow claims that "[i]f a user buys a device bearing the Android trademark that does not have the preinstalled apps she expects, or if the Google Apps on her device do not function correctly, this will likely impact her perception of Google and Android more broadly."[182] The same could be said of OEMs. For example, if a Samsung device does not come included with the out-of-the-box functionality expected and valued by the user, this will likely have a negative effect on the consumer's perception of Samsung more broadly. Dr. Gentzkow cites evidence that OEMs choose to preinstall GMS Apps "because of the value they provide," even when they are not required to do so by the MADA.[183] This undermines Dr. Gentzkow's claim that OEMs would be disincentivized to deliver value to users in the absence of the MADAs and suggests that the MADAs instead had the effect of giving preferential placement of the Play Store relative to other App stores.

87. Dr. Gentzkow reviews evidence which "suggests that having the GMS apps preinstalled is what a large majority of users want and expect."[184] If that is the case, then Google does not need to impose contractual restrictions on OEMs requiring them to distribute the entire suite of GMS apps. OEMs have clear economic incentives to offer devices that include functionality that users want and expect. In any event, this claim highlights Google's leverage. Because users expect some of the GMS suite of Apps, Google is able to require the OEMs to install *every* App within that suite, including the Play Store. In addition, as a result of the terms of the MADAs, OEMs are unable to exercise their own judgment as to whether or not users would prefer to have an alternate App store appear on the default home screen rather than Google Play. Because the MADAs require the Play Store to appear on every single default home screen, no other App store can vie for more prominent placement than Google. This is true regardless of how much the alternative App store might be willing to pay.[185]

88. Dr. Gentzkow claims that "the specific MADA provision that offers the suite of Google's apps as a group is essentially a barter through which Google licenses valuable intellectual property at a price of zero in exchange for OEMs preconfiguring these devices in specific ways

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https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1048746/MobileEcosystems_InterimReport.pdf.

181. Gentzkow Report ¶275.
182. Gentzkow Report ¶280.
183. Gentzkow Report ¶312.
184. Gentzkow Report ¶276.
185. In my Merits Report, I explained that "[t]he MADAs prevented an OEM from customizing the Apps on mobile devices by precluding an alternative bundle comprised of a rival App store (including Amazon's App store) *alongside* Google's other popular (non-Play Store) Apps—that is, a rival App store would need to compete across every dimension of Google's App suite at once, effectively raising its costs." Singer Report ¶198. This would not necessarily preclude the Play Store from being included in the GMS suite; it would simply allow for the Amazon App Store to be placed as the sole App Store on the Default Home Screen.

that provide value to Google…and providing wider distribution of apps that generate revenue for Google."[186] According to Dr. Gentzkow, "[w]ithout the requirement that OEMs preinstall the full suite of GMS apps, some OEMs could choose to obtain the benefits of the free intellectual property by taking apps they perceive to be most valuable while foregoing other apps that are important for Google to obtain its value in exchange."[187] In fact, Google's all-or-nothing bundling of the GMS suite is anticompetitive because an equally efficient competitor could not profitably compete with it: There is no amount of money that a competing App store could offer an OEM that would provide sufficient compensation for the OEM to preinstall the competing App store instead of (or more prominently than) the Play Store.[188] Google's intellectual property is licensed for "free" because doing so allows Google to extract supracompetitive profit in the Android App Distribution Market and the In-App Aftermarket.[189]

89. Dr. Gentzkow claims that "the MADA provides direct incentives to OEMs to install system updates in a timely manner," improving device security.[190] According to Dr. Gentzkow, "OEMs' own incentives to install software updates may not be aligned with what creates the most value for the platform as a whole.… Google Play services, which is part of the suite of apps and services licensed under the MADA…helps circumvent this issue by providing a means of updating Google apps and apps installed from Google Play, even if the device has not been updated by the OEM."[191] This claim is irrelevant because I understand Consumer Plaintiffs are not challenging Google's requirement for security updates.

90. Dr. Gentzkow claims that the MADA is procompetitive because it was introduced in 2009, when Android and Android Market were new entrants, and therefore could not have been exercising market power. I have responded to this claim in Part II.A above. Additionally, while Dr. Gentzkow argues that "the structure of the MADA has remained largely unchanged since,"[192] he fails to recognize that the balance of content in GMS as compared to AOSP has changed significantly since 2009. Over time, Google has migrated core API and App functionality into GMS rather than AOSP.[193]

91. Dr. Gentzkow claims that the MADA is procompetitive because "[o]ther platforms that had limited market penetration and could not reasonably be considered to have monopoly power also required or implemented preinstallation of a full suite of platform-sponsored apps on

186. Gentzkow Report ¶285.
187. Gentzkow Report ¶285.
188. Singer Merits Report ¶246.
189. Dr. Gentzkow claims that "When Google was required by the European Commission to offer Search and Chrome separately from other GMS apps, they…charg[ed] OEMs a substantial licensing fee for the 'core' apps Gmail, Maps, YouTube, and Google Play. Features of the smartphone production industry suggest that this will tend to raise the price that users ultimately pay for device." Gentzkow Report ¶286. Dr. Gentzkow provides no evidence that device prices in Europe increased as a result. In addition, I understand that any purported "offsets" outside the relevant market are not relevant here. *See* Ted Tatos & Hal Singer, *The Abuse of Offsets as Procompetitive Justifications: Restoring the Proper Role of Efficiencies after Ohio v. American Express and NCAA v. Alston* 38(4) GEORGIA STATE UNIVERSITY LAW REVIEW (2022), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4113547.
190. Gentzkow Report ¶287.
191. Gentzkow Report ¶288.
192. Gentzkow Report ¶ 292.
193. Schmidt Report ¶ ¶ 32- 35.

their devices."[194] But Dr. Gentzkow does not present any evidence that any of the platforms he listed *required* preloading of platform-sponsored apps. Rather, each of the devices discussed by Dr. Gentzkow—the Amazon Fire Phone, the Windows Lumia 950, and the Blackberry Z10—were manufactured by the platform provider.[195] That some OEMs lacking monopoly power chose to preload their own apps does not demonstrate that it is procompetitive for Google to require OEMs to make it impossible for rivals to displace the Play Store. Moreover, Dr. Gentzkow ignores that conduct may be anticompetitive when undertaken by a firm with monopoly power, even if it is not anticompetitive when undertaken by a competitive firm.[196]

92. Dr. Gentzkow claims that "OEMs not only can but do preinstall and prominently display alternative app stores."[197] But the MADAs did not need to restrict pre-installation in order to be anticompetitive. As explained above, the MADAs leverage Google's market power in the GMS suite to ensure that the Play Store will always appear on the default home screen, making it impossible for rivals to displace the Play Store. The best a would-be rival could achieve would be side-by-side with Google Play. Given Google's incumbency advantage, would-be rivals face clear disincentives to compete for that privilege. And when Google has been faced with potential competitors with both the resources to achieve pre-installation and an established user base (such as Facebook), Google has deployed measures to restrict their ability to compete and incentivized them not to compete in the Android App Distribution Market.[198]

93. In my Merits Report, I explained that Google's all-or-nothing bundling of the GMS suite can be shown to be anticompetitive under the "discount attribution test," or the *Cascade* test.[199] Dr. Gentzkow critiques my application of the discount attribution test. First, he asserts that the OEM gives up nothing if it preinstalls a rival App store, so that there is no penalty or foregone discount.[200] This is not the relevant comparison. If the OEM were to preinstall a rival App store and place it on the default home screen in place of the Play Store, it would incur the immense penalty of losing access to the entire GMS suite. An equally efficient rival App store could not compensate the OEM for this penalty and still earn a profit. Therefore, no equally efficient rival App store can outbid Google for *preferred* placement.

94. Dr. Gentzkow then incorrectly states that the discount attribution test is not applicable because "it would require assuming that Google Play and rival app stores are indistinguishable from consumers' perspective."[201] Dr. Gentzkow is wrong. The discount attribution test is not performed with respect to an actual competitor (such as the Amazon App Store), but rather a *hypothetical* equally efficient rival, which by definition would offer the same selection of Apps at the same cost as the Play Store.

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194. Gentzkow Report ¶¶293-294.

195. Gentzkow Report ¶ 293 and sources cited therein.

196. *See, e.g.,* Douglas Bernheim and Randal Heeb, *A Framework for the Economic Analysis of Exclusionary Conduct*, OXFORD HANDBOOK OF INTERNATIONAL ANTITRUST ECONOMICS, Vol. 2 (2014) at 30.

197. Gentzkow Report ¶¶296-297.

198. Singer Merits Report ¶¶231-237.

199. Singer Merits Report ¶246.

200. Gentzkow Report ¶308.

201. Gentzkow Report ¶309.

95. Dr. Gentzkow further claims incorrectly that the discount attribution test is not applicable because it assumes that the firm engaging in anticompetitive bundling has market power in the tied product; in other words, Dr. Gentzkow disputes the notion that Google has monopoly power in the GMS suite.[202] In fact, Google's market power in GMS Apps such as Google Search, Maps, Gmail, and YouTube is well established.[203] Moreover, Google has monopoly power in the market for licensable mobile operating systems. As explained by Dr. Schmidt, key portions of Google Android are contained within the GMS suite because the GMS APIs are crucial for Apps to run on the Android operating system.[204] And as Dr. Gentzkow acknowledges, the trademark to the Android operating system is also bundled as part of the MADA.[205] Dr. Gentzkow's Exhibit 30 provides compelling direct evidence of Google's monopoly power.[206]

3. Dr. Gentzkow Fails to Demonstrate that the Early RSAs Were Procompetitive

96. As I explained in my Merits Report, Google's RSAs were part of a long-term strategy that allowed Google to achieve dominance and engage in anticompetitive exclusionary conduct by impairing competitive entry and expansion by would-be horizontal rivals in the Android App Distribution Market.[207] Google's early RSAs were predatory because the five percentage points of revenue retained by Google from each transaction did not cover its marginal costs.[208]

97. Dr. Gentzkow incorrectly characterizes the early RSAs as "form of penetration pricing that helped coordinate early adoption of the Android Market platform," and appeals to the literature on two-sided platforms to support his claim.[209] In fact, the literature does not support his claim. *First*, to support his incorrect claims on predation, Dr. Gentzkow cites to economic literature stating that "tests [for predation] are motivated by the standard theoretical result that profit-maximizing prices are never below marginal cost. But for multisided platforms, as a matter of theory, the profit-maximizing price to one or more sides (*though not, of course, to all*) could be lower than marginal cost…."[210] In other words, below-cost predatory pricing is not economically justified on a platform-wide basis. Thus, even assuming counterfactually that developers in the early years had paid only Google's initial take rate of five percent (instead of the 30 percent they actually paid), the early RSAs would still have been predatory because the total price to both sides of the market (developers and consumers) would have been below marginal cost: Google retained

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202. Gentzkow Report ¶¶302-306.

203. Singer Merits Report ¶194.

204. Schmidt Report ¶ 39 ("With its inclusion of GMS, Google has effectively created an entirely new platform that is incompatible with AOSP … Apps that are written for Google Android with GMS are not compatible with AOSP Android".).

205. Gentzkow Report ¶ 265 & n.379.

206. Dr. Gentzkow's Exhibit 30 shows Huawei's share of new smartphones sold worldwide (excluding China) falling off rapidly after the OEM was denied access to GMS due to an executive order. *See also* Gentzkow Report ¶277, n. 425 (citing a research report according to which the absence of GMS was a significant factor in the perception of success of Huawei's products by customers.)

207. Singer Merits Report Part IV.A.

208. Singer Merits Report ¶¶178-179.

209. Gentzkow Report ¶¶98-99.

210. Gentzkow Report ¶361, citing David Evans and Richard Schmalensee, *The Antitrust Analysis of Multisided Platform Businesses* OXFORD HANDBOOK OF INTERNATIONAL ANTITRUST ECONOMICS 404, 433 (2014) (emphasis added).

only 5 percent of the transaction value—less than its marginal costs—from both sides of the market. *Second*, for the claim to be economically plausible, it would have to be the case that the revenue-sharing payments were used to lower the price of the Play Store to developers (and/or consumers). Subsidizing developers could entice more consumers to the Play Store, and vice-versa. But as I explained in my Merits Report, it did neither; the take rate in the Play Store was set to 30 percent even in the early years, with Google retaining five percentage points (sometimes less), and OEMs and mobile carriers retaining the rest.[211] Dr. Gentzkow is therefore incorrect to draw an analogy between the Play Store and "shopping malls that often subsidize the rent of large tenants early on, then reduce or eliminate that subsidy once the mall has attracted a steady stream of customers."[212] The developers' "rent" was not subsidized by the RSAs, nor were consumer prices.

98. Dr. Gentzkow suggests that "revenue-sharing payments will tend to reduce the price that users ultimately pay for devices and service from MNOs" but provides no quantification of the impact of such a price cut.[213] Even assuming that there was a device price cut, it would have been outside the relevant markets at issue here and would not have affected the App prices developers set or consumers pay within the Play Store. In any event, Google removed the vast majority of the Play Store revenue shared with the carriers as its dominance was established, such that any price cut for users of the devices would have been transitory.

99. Dr. Gentzkow suggests "that revenue-sharing payments will increase MNOs' incentives to invest in configuring Android devices in ways that increase user value" but provides no evidence that the RSAs incentivized carriers to make investments that benefitted consumers, as opposed to Google.[214] Nor does he provide any evidence on the nature or economic significance of any such investments. Even assuming that the RSAs caused economically significant investments to "promote Android devices," Dr. Gentzkow does not explain why the RSA payments needed to be so large as to leave Google without enough to cover its marginal costs. Put differently, Dr. Gentzkow does not explain why these purported procompetitive benefits could not have been achieved without predation. Moreover, any such investments would be outside the relevant markets at issue here, and would not subsidize developers or consumers within the Play Store.

100. Dr. Gentzkow allows for the possibility that "the early RSAs did contribute to some MNOs or OEMs deciding to forego the option of creating their own separate app stores," but claims that "this would have provided another significant benefit to Android platform participants by limiting fragmentation into walled garden app stores."[215] I respond to Dr. Gentzkow's incorrect claims regarding fragmentation in Part II.C.3.

101. Dr. Gentzkow claims incorrectly that the early RSAs were not predatory because "[p]ayments to MNOs cannot be predation directed at MNOs since the net effect of these payments

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211. Singer Merits Report ¶¶177-178.
212. Gentzkow Report ¶100.
213. Gentzkow Report ¶325.
214. Gentzkow Report ¶326.
215. Gentzkow Report ¶331.

is to increase rather than decrease the MNOs' profits."[216] But as Dr. Gentzkow concedes (correctly), predation "refers to a firm setting a price…that is profitable only because it drives one or more current or potential competitors out of the market."[217] The early RSAs were, in fact, unprofitable for Google while they were in effect in the Android App Distribution Market, and profitable in the long run because they successfully deterred entry and/or expansion in the Android App Distribution Market and allowed Google to recoup by increasing its percentage take. As a source relied upon by Dr. Gentzkow confirms, "[t]he evidence need not be about whether the prey was forced out of the market or whether its cash flow remained positive. What should be proved…is that the alleged predation turned a profitable entry opportunity into an unprofitable one."[218] The early RSAs satisfy this definition of predation.

102. Dr. Gentzkow does not dispute the evidence showing that, when Google retained only five percent (or less) of developer revenue, it was not covering even its marginal costs of serving the Android App Distribution Market, taking into account pricing on both sides of the platform.[219] Dr. Gentzkow claims instead that these losses should be offset by purported benefits outside Android App Distribution Market. Specifically, Dr. Gentzkow claims that the early RSAs were profitable even in the short run because they "increased sales and usage of Android devices and thereby increased Google's revenue from a range of streams including advertising.…Even if Google had chosen to share *100 percent* of service fee revenue with MNOs, these agreements could very likely have been profitable in the short-run due to the substantial profits Google earned from the broader growth of Android."[220] This may well be correct—indeed, it is consistent with the conclusion that charging a substantially lower take rate in a more competitive but-for world would not cause Google to offset the lost revenue by charging even a modest fee on consumers,[221] or by taking other measures to cut costs by reducing the scope, quality, or security of services provided by the Play Store. However, predation is properly assessed from the perspective of an equally efficient competitor in the Android App Distribution Market, not a cross-market competitor. As a result, any such offsets do not negate my conclusion that the RSAs were predatory within the Android App Distribution Market.[222]

103. Elsewhere, Dr. Gentzkow claims that "low introductory prices are fully consistent with competition and efficiency" and that other firms that "have in fact introduced app or game stores that incurred losses for a number of years."[223] Dr. Gentzkow ignores the difference between the type of up-front sunk costs and fixed costs that characterize technology investments and ongoing marginal costs that are the subject of predation here. Given that Google was losing money

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216. Gentzkow Report ¶¶359-360. Even if one were to credit Dr. Gentzkow's response, this argument does nothing to undermine the fact that the revenue share agreements also made it unprofitable for third-party stores to acquire the right to preloading on carriers' phones.

217. Gentzkow Report ¶359.

218. Gentzkow Report ¶359, n. 569 (citing Nicola Giocoli, *Games Judges Don't Play: Predatory Pricing and Strategic Reasoning in US Antitrust*, 21(1) SUPREME COURT ECONOMIC REVIEW 271, 302 (2013)).

219. Gentzkow Report ¶361.

220. Gentzkow Report ¶361(c) (emphasis in original).

221. Singer Merits Report ¶¶401-404.

222. *See, e.g.,* Ted Tatos & Hal Singer, *The Abuse of Offsets as Procompetitive Justifications: Restoring the Proper Role of Efficiencies after Ohio v. American Express and NCAA v. Alston* 38(4) GEORGIA STATE UNIVERSITY LAW REVIEW (2022).

223. Gentzkow Report ¶361(a),(d).

on a transaction-by-transaction basis, an equally efficient rival could not have competed profitably even if it had incurred the sunk and fixed costs necessary to deploy its own App store.

104. Dr. Gentzkow claims incorrectly that I do not establish that Google recouped its initial losses from predatory pricing.[224] Google's pricing was predatory because it retained only 5 percent of each transaction while the RSAs were in effect. As I explained in my Merits Report, the Play Store has become highly profitable over the long run, as Google has increased the percentage of each transaction it retains to 30 percent in most cases. This take rate is supracompetitive, allowing Google to earn monopoly profit.[225]

4. Dr. Gentzkow Fails to Demonstrate that the Later RSAs Were Procompetitive

105. Dr. Gentzkow claims that the Google's later RSAs, which he defines as "typically those signed in 2014 or later, and generally referred to by Google as RSA2s/RSA 2.0s and RSA3s/RSA 3.0s,"[226] were procompetitive for some of the same reasons he claims that the early RSAs were procompetitive.[227] I respond to these claims in Part II.B.3 above.

106. As explained in Part II.C.1, Google has deployed Premier Tier RSAs, which explicitly prohibit preinstallation of competing App stores, to ward off new potential competition in the Android App Distribution Market. Dr. Gentzkow acknowledges that the Premier Tier RSAs forbid preinstallation of competing App stores.[228]

107. Dr. Gentzkow claims that the Premier Tier RSAs are "analogous to Coke offering McDonald's a discount off the regular wholesale price of its products in exchange for McDonald's featuring and promoting Coke products prominently and/or exclusively in their stores."[229] This economic analogy does not support Dr. Gentzkow's claim. Dr. Gentzkow ignores that Coke would presumably need to compete for the right to exclusivity with at least one similarly situated rival (Pepsi). In this case, there is no Pepsi to compete with Google's Coke. In a more competitive but-for world, a rival such as Amazon would play the role of Pepsi. More generally, Dr. Gentzkow has no basis to assume that exclusive distribution arrangements involving major soft drink brands are automatically procompetitive; they may be, but the answer depends on questions of market power. For example, if Coke merged with Pepsi to form a soft drink monopoly, it might be able to impose anticompetitive exclusive arrangements on retailers that would substantially foreclose competition in the soft drink market.[230]

108. More fundamentally, no other equally efficient App store could *ever* secure the terms that Google has secured for itself in the RSA 3 Premier Tier agreements because Google

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224. Gentzkow Report ¶361(e).
225. Singer Merits Report ¶183.
226. Gentzkow Report ¶365.
227. He claims that the later RSAs "will tend to lead to lower device prices," and that they increase "the incentives of OEMs and MNOs to invest in and support the Android platform." He also claims that the later RSAs "provide incentives to update devices in a timely manner." Gentzkow Report ¶376.
228. Gentzkow Report ¶377.
229. Gentzkow Report ¶377.
230. *See, e.g.,* Steven Salop, *The Raising Rivals' Cost Foreclosure Paradigm, Conditional Pricing Practices, and the Flawed Incremental Price-Cost Test* 81(2) ANTITRUST LAW JOURNAL 371 (2017).

requires Google Play to be preloaded on any device running Google Android on the default home screen. To extend the analogy above, Pepsi would not have the option of bidding for exclusive placement within McDonalds.

109. Dr. Gentzkow claims that the Premier Tier RSAs "provide incentives to OEMs and MNOs to create a clean, consistent, and high-quality out-of-the-box experience for users that strengthens the Android brand."[231] I have responded to this claim in Part II.B.2 above. Relatedly, Dr. Gentzkow asserts that the Premier Tier RSAs "have a clear procompetitive rationale" because, he claims, they help to limit "bloatware."[232] To support his claim, Dr. Gentzkow conflates preinstallation of a competing App store with all manner of unrelated software. For example, he references a 2012 paper describing bloatware as "pages and pages of applications that we had no need for. There were more than 60 applications for services, games, and tools that we didn't want."[233] Separately, Dr. Gentzkow relies on a 2020 document from Privacy International expressing concern regarding "devices that contain pre-installed apps that cannot be deleted (often known as 'bloatware'), which can leave users vulnerable to their data being collected, shared, and exposed without their knowledge or consent."[234] Taken as a whole, the "bloatware" evidence reviewed by Dr. Gentzkow suggests that the Challenged Conduct has not been particularly effective in delivering the "consistent, and high-quality out-of-the-box experience" that Dr. Gentzkow claims it does. In any case, Dr. Gentzkow does not explain why "bloatware" could not be addressed without prohibiting the preinstallation of any competing App store.

110. After defending the Premier Tier RSAs as purportedly critical to ensuring a high-quality user experience, Dr. Gentzkow then proceeds to defend them by claiming that they are actually not all that common.[235] Yet Dr. Gentzkow's own Exhibit 34 shows that nearly [redacted] percent of GMS device activations were subject to these contracts as of August 2022. As explained in Part II.B.1 above, nearly [redacted] percent of new device activations by Chinese OEMs were subject to these contracts.

111. Dr. Gentzkow claims that the Premier Tier RSAs provide incentives "to limit app store fragmentation."[236] I respond to Dr. Gentzkow's incorrect claims regarding fragmentation in Part II.C.3.

5. Dr. Gentzkow Fails to Demonstrate that Project Hug Is Procompetitive

112. As I explained in my Merits Report, Google's Project Hug impaired entry and expansion by competing App stores. Project Hug secured content from some of the largest developers, which precluded them from offering competing App stores the exclusive content necessary to help drive usage; Project Hug also imposed content parity requirements for certain

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231. Gentzkow Report ¶376.

232. Gentzkow Report ¶¶377-390.

233. Gentzkow Report ¶382, citing Patrick McDaniel, *Bloatware Comes to the Smartphone* 10(4) *IEEE Security & Privacy* (2012) at 85-87.

234. Gentzkow Report ¶386, citing Privacy International, *An Open Letter to Google*, (January 8, 2020), https://privacyinternational.org/advocacy/3320/open-letter-google.

235. Gentzkow Report ¶¶396-400; ¶419.

236. Gentzkow Report ¶376.

developers. Project Hug is anticompetitive through the standard economic lens of an MFN imposed by a dominant platform.[237]

113. Dr. Gentzkow claims that that economic literature suggests that MFNs can be efficient under some circumstances,[238] but ignores that the 2013 article he cites explains that MFNs are more likely to raise anticompetitive concerns when they are adopted by firms with substantial market power, as is the case here.[239] Moreover, he ignores the more recent and relevant 2018 article that helped to frame my analysis, which deals specifically with online platforms such as the Play Store; the authors conclude they are "skeptical" that efficiency justifications for platform MFNs "will routinely prevail."[240]

114. Dr. Gentzkow claims that Project Hug's "sim-ship" requirements "are a simple and low-cost way to agree that, in exchange for the valuable services and discounts Google provides, an app developer will offer its future apps on Google Play in a timely manner and in full-featured versions."[241] This ignores that Project Hug, like all MFNs, consists of contracts that reference rivals, whose potential for anticompetitive harm is well established among antitrust practitioners.[242] In this case, Project Hug restricts rival App stores' ability to differentiate themselves and gain traction with developers. As the dominant incumbent, the Play Store is

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237. Singer Merits Report Part IV.A.3.b. *See also* Jonathan B. Baker & Fiona Scott Morton, *Antitrust Enforcement Against Platform MFNs*, 127(7) YALE LAW JOURNAL 2176-2202 (2018) [hereafter, Baker & Scott Morton (2018)].

238. Gentzkow Report ¶454, citing Steven Salop & Fiona Scott Morton, "Developing an Administrable MFN Enforcement Policy," *Antitrust* 15-19 (2013), at 15 [hereafter, Salop & Scott Morton (2013)].

239. Salop & Scott Morton (2013) at 18. Another article cited by Dr. Gentzkow explains that "MFNs may also harm competition by assisting an incumbent in foreclosing the entry or expansion of rivals." Jonathan Baker & Judith Chevalier, *The Competitive Consequences of Most-Favored-Nation Provisions* 27(2) ANTITRUST 20, 24 (2013) (cited in Gentzkow Report ¶456).

240. Baker & Scott Morton (2018) at 2183. Dr. Gentzkow claims he is "not aware of any model of an MFN involving the kinds of timing and quality provisions at issue in Project Hug." Gentzkow Report ¶454, n. 739. Here, Project Hug raised the quality-adjusted price of content available to developers, consistent with the literature. Baker & Scott Morton (2018) at 2185, n. 28 (reviewing a study in which an online platform responded to an MFN ban by "introducing quality improvements to the service it provided…suggesting online platform competition increased when platform MFNs were banned"). According to antitrust economist Fiona Scott-Morton (formerly of the DOJ Antitrust Division) "a contract between a buyer and a seller may refer to, and its terms may depend on, information outside the buyer-seller relationship: information from other transactions to which those same firms are party. Those references may be either explicit or implicit, and they can involve a host of factors, including price terms, non-price terms, terms pertaining to the buyer's rivals, or terms pertaining to the seller's rivals. I call these Contracts that Reference Rivals, or CRR." Fiona Scott-Morton, *Contracts that Reference Rivals*, Georgetown University Law Center (2012), at 2 [hereafter, Scott Morton (2012)]. MFNs are CRRs because they "typically result in the covered buyer knowing its rivals' prices (or other provisions of the contract) are no higher than its own." *Id.* at 3.

241. Gentzkow Report ¶455.

242. *See, e.g.,* Scott-Morton (2012) at 2 ("[T]he economics literature has identified many circumstances where CRRs [contracts that reference rivals] have the potential to harm consumers and competition, particularly…when they involve firms with market power. CRRs have thus been, and will continue to be, the subject of antitrust scrutiny, both at the government and in private litigation.") *See also id* at 5. ("The economic literature indicates that the settings where CRRs are most likely to harm consumers and competition involve dominant firms possessing market power and a high market share.").

uniquely positioned and incentivized to impose MFNs that foreclose competition from would-be rivals in the Android App Distribution Market.[243]

115. Dr. Gentzkow suggests incorrectly that the anticompetitive effects of MFNs are "generally focused" on "tacit collusion among sellers," and suggests that the exclusion of rivals is an "alternative theory."[244] In fact, economists recognize anticompetitive exclusions as one of the primary forms of anticompetitive harm associated with MFNs.[245]

6. Dr. Gentzkow Fails to Demonstrate that Google's Unnecessary Technical Barriers Are Procompetitive

116. I explained in my Merits Report that Google has impaired competition in the Android App Distribution Market by imposing unnecessary technical barriers, including default settings and warnings that make it unnecessarily difficult and cumbersome for users to download rival App stores and to sideload Apps. Google has also historically restricted auto-updating capabilities for Apps not listed in the Play Store or App stores pre-installed by OEMs. My opinions on technical barriers depend on the findings of Plaintiffs' technical expert, Professor Schmidt, who finds that Google's technical barriers exceeded what would have been necessary for security purposes.[246] Dr. Gentzkow also claims, relying on Dr. Qian's report, that less restrictive security restrictions would be more costly, but I understand that Dr. Schmidt's analysis shows that would not be the case.[247]

117. Dr. Gentzkow claims "[s]ecurity is a key feature demanded by users," and cites evidence and testimony to this effect.[248] The relevant question is not whether users value security—to my knowledge, no expert in this case has claimed otherwise—but rather whether Google imposed barriers that were unnecessary from a technical perspective. I understand that Professor Schmidt has found that Google did so.

118. Dr. Gentzkow claims that "[t]he challenged conduct related to security has also not foreclosed access to apps via direct downloads."[249] As I explain above, Dr. Gentzkow's claim that any form of "access" proves that foreclosure did not occur is divorced from standard antitrust economics. In addition, the data relied upon by Dr. Gentzkow show that [redacted] percent of devices worldwide and 81 percent in the United States have not enabled permissions for even one app to download from unknown sources.[250]

243. *Id. See also* Baker & Scott Morton (2018) at 2181 ("A platform MFN imposed by an incumbent OTA could prevent these outbreaks of competition")

244. Gentzkow Report ¶¶457-458.

245. Baker & Scott Morton (2018) at 2180.

246. Singer Merits Report Part IV.A.4. Likewise, although Dr. Gentzkow claims that "other platforms adopt similar safeguards," Gentzkow Report ¶478, I understand that Dr. Schmidt shows that Google's technical barriers are materially different from those on the platforms Dr. Gentzkow claims are analogous. *See, e.g.,* Schmidt Report ¶ 107 ("Other mechanisms exist to easily verify not only the identity of the developer, but also to validate the authenticity and safety of the app," using Windows as an example).

247. Gentzkow Report ¶489.

248. Gentzkow Report ¶¶470-475.

249. Gentzkow Report ¶483.

250. Gentzkow Report ¶485 and Exhibit 37.

These data support the conclusion that Google's "Unknown Sources" restrictions foreclose competing app stores from reaching a substantial portion of consumers.

119. Dr. Gentzkow claims "challenged conduct related to security also enables Google to offer users informed choice."[251] He does not explain why requiring a series of ominous warnings even for reputable App stores such as the Amazon App Store makes users better informed, as opposed to causing users to conflate reputable App stores with "[m]alware and other harmful downloads."[252]

7. Dr. Gentzkow Fails to Demonstrate that Google's Developer Distribution Agreements Are Procompetitive

120. In my Merits Report, I explained that Google's developer distribution agreements ("DDAs") impair competition from rivals in the Android App Distribution Market because they forbid distribution of competing App stores through the Play Store, and because they ban developers from steering users to lower-priced App distribution channels or from using user information learned through the Play Store.[253]

121. Dr. Gentzkow claims that removing these restrictions "would encourage free riding that would likely degrade the long-run quality of the Android platform."[254] Dr. Gentzkow's claim is unsupported by any evidence. As explained in my Merits Report, Google would continue to serve 60 percent of the Android App Distribution Market in the but-for world;[255] Google would also continue to reap significant profits from other sources such as advertising and Search.[256] I understand further that Mr. Chase's analysis shows that Google Play would remain profitable. Even assuming that Dr. Gentzkow is correct in asserting that Google uses Play's profits to invest in the "long-run quality of the Android platform," he has shown no evidence to support the claim that the DDA restrictions would affect Google's abilities or incentives to invest in the platform.

122. Dr. Gentzkow also ignores that the DDAs reinforced the Challenged Conduct by removing yet another alternative distribution channel for would-be rivals in the Android App Distribution Market. In a more competitive but-for world, a robust rival such as the Amazon App Store would presumably not be materially impaired by the DDAs, provided it was preinstalled (or easily installed by users) on a sufficient number of devices.

123. Dr. Gentzkow claims that the DDA is not anticompetitive because "other platforms adopt similar provisions."[257] Dr. Gentzkow ignores the possibility that these platforms are simply mimicking the behavior of the dominant incumbent, and the fact that such conduct can be anticompetitive when undertaken by a dominant firm, but potentially procompetitive otherwise. Dr. Gentzkow also claims that, because Google introduced the DDA in 2008, it could not have

251. Gentzkow Report ¶476.
252. Gentzkow Report ¶473, ¶475 n.784. Dr. Gentzkow's Fortnite example demonstrates how Google's ominous warnings caused users to conflate legitimate alternatives with malware. *Id.*
253. Singer Merits Report ¶¶213-214.
254. Gentzkow Report ¶508.
255. Singer Report ¶304, at 139.
256. Singer Report ¶¶400-404.
257. Gentzkow Report ¶510.

reflected the exercise of Google's monopoly power. I have responded to this claim in Part II.A above.

8. Dr. Gentzkow Fails to Demonstrate that the Aftermarket Tie-In Is Procompetitive

124. Antitrust economists recognize that high-tech platform markets are susceptible to the exercise of monopoly power via anticompetitive tying.[258] In my Merits Report, I explained that the In-App Aftermarket Tie-In is anticompetitive according to standard antitrust principles, according to which Google has gained and maintained significant market power in the In-App Aftermarket through anticompetitive, exclusionary contractual restrictions that function as an economic tie-in of Google's Android App Distribution Market services to its In-App Aftermarket services.[259] My Merits Report explained further that the In-App Aftermarket Tie-In cannot be deemed procompetitive based on the "Single Monopoly Profit" theory that has been used by some antitrust practitioners to justify tying on efficiency grounds.[260] Dr. Gentzkow does not claim that the Single Monopoly Profit theory applies here.

125. Ignoring standard antitrust economics, Dr. Gentzkow claims the In-App Aftermarket Tie-In is "consistent with the principles" he deems would "tend to characterize an effective service fee structure."[261] Dr. Gentzkow claims that these "principles" are derived from the economic literature but fails to cite a *single article* that actually deals with tying.[262] Instead, Dr. Gentzkow relies on articles from the two-sided market literature and the operations literature to support (some) of his self-proclaimed "principles" for an "effective" take-rate structure.[263] Not one of the articles endorses tying as a procompetitive pricing structure. The pricing structures covered in these articles are different (e.g., determining the optimal fee structure for merchants and cardholders on a payment card system). There is no tying to be addressed because there is only one product on each side of the platform.

126. Dr. Gentzkow asserts that "effective service fees will tend to be proportional to an app developer's earnings from eligible transactions rather than a fixed amount that is the same for all app developers."[264] In the but-for world as I have characterized it, Google would continue to collect a take rate in proportion to developer revenue—the difference being that Google would have to compete for that business and, hence, would collect a lower proportion of developer revenue than it does in the actual world. Dr. Gentzkow's "proportionality" requirement does not explain why Google would need to capture 100 percent of the In-App Aftermarket in a more competitive but-for world, or why Google would need to charge a monopolistic take rate of 30 percent as opposed to a more competitive take rate of approximately 15 percent. As I explained in

258. *See* Susan Athey & Fiona Scott Morton, *Platform Annexation* 84 ANTITRUST LAW JOURNAL (2022) 677, 696-697 [hereafter, Athey & Scott Morton (2022)].

259. Singer Merits Report Part V.A-V.B.

260. Singer Merits Report Part V.C.

261. Gentzkow Report ¶¶144-154.

262. Gentzkow Report ¶¶137-153.

263. Dr. Gentzkow fails to cite any economic literature in support of two of his five "principles." Gentzkow Report ¶¶144-153.

264. Gentzkow Report ¶146.

my Merits Report, Google would continue to monetize the In-App Aftermarket in a more competitive but-for world and would continue to do so profitably.[265]

127. Dr. Gentzkow claims incorrectly that, without the In-App Aftermarket Tie-In, "Google would have to collect its service fee from developers who use third-party billing systems by other means."[266] In a more competitive but-for world, Google would still be able to compete for and collect its take rate from all developers whose business it could win based on competition on the merits, and Google could still use GPB to do so. Dr. Gentzkow's claim that the In-App Aftermarket Tie-In "contributes to secure, efficient, and reliable collection of the service fee"[267] ignores that, in a more competitive but-for world, Google could still collect its take rate using the same systems it uses today for any and all business earned on the merits.

128. Dr. Gentzkow's references to the costs of "comply[ing] with recent South Korean and European legislation requiring billing optionality"[268] are irrelevant; in a more competitive but-for world, competition would have dictated the structure of Google's billing systems from the beginning, with Google collecting revenue only on transactions for which it competed successfully on the merits. Moreover, competitive billing systems would have clear economic incentives to integrate seamlessly and efficiently with their customers in the but-for world.

129. Dr. Gentzkow claims that "[b]eing unable to collect its service fee accurately and reliably would undermine Google's incentive to invest."[269] This ignores that Google would continue to profitably monetize the In-App Aftermarket in a more competitive but-for world.[270] Dr. Gentzkow also ignores his admission that "the broader growth of Android" would ensure Google's profitability even if its take rate were zero.[271]

130. Dr. Gentzkow's Exhibit 38 includes many misleading examples of what he calls "Platforms Requiring On-Platform Payment." Dr. Gentzkow continues to ignore the elementary economic fact that tying requires separate products; most of the examples he cites involve fees that would likely pertain to a single product, with no analog to the In-App Aftermarket.[272] For example, Dr. Gentzkow does not suggest that there exists an aftermarket associated with ride hailing services such as Uber or Lyft, much less that Uber or Lyft require payments in that aftermarket to go through their platforms. The absence of an aftermarket explains the irrelevance of Dr. Gentzkow's misguided economic analogy of parties conspiring to avoid Airbnb fees.[273] Dr. Gentzkow also makes no effort to demonstrate that the companies listed in Exhibit 38 are in competitive industries. For example, Steam is estimated to control approximately three-quarters of PC gaming sales.[274] In

265. Singer Merits Report ¶400. Dr. Gentzkow also ignores that Google's take rate structure in the actual world does not fully conform to his "proportionality" requirement. For example, developers that sell physical services or products (such as Uber) pay a take rate of zero.

266. Gentzkow Report ¶528.

267. Gentzkow Report ¶¶533-535.

268. Gentzkow Report ¶531.

269. Gentzkow Report ¶532.

270. Singer Merits Report ¶400.

271. Gentzkow Report ¶361(c).

272. These include Amazon (physical goods), eBay, Etsy, Walmart Marketplace, Rover, TaskRabbit, StubHub, Grubhub, Uber/Uber Eats, Lyft, VRBO/HomeAway, and AirBnB.

273. Gentzkow Report ¶539.

274. Singer Merits Report ¶314, n. 715.

Appendix 5, I review the flaws in the various platform benchmarks proposed by Dr. Gentzkow and other Google Experts.

131. Dr. Gentzkow lists various claimed advantages of GPB.[275] These advantages would remain in a more competitive but-for world, and Google could leverage them to compete on the merits. Of course, Google's competitors in the but-for world would also be motivated to provide desirable features on their own payment systems.

132. Dr. Gentzkow claims incorrectly that the In-App Aftermarket is limited to the billing system alone.[276] In fact, I clearly defined the In-App Aftermarket as "the aftermarket for services in support of consummating purchases of In-App Content on Android devices."[277] Paddle, a potential entrant in the In-App Aftermarket, advertises a range of services beyond payment processing.[278] When estimating Google's cost of providing In-App Aftermarket services, I included many cost categories beyond transaction fees.[279] If the In-App Aftermarket were limited only to payment processing, the competitive take rate would be significantly lower than but-for take rate of approximately 15 percent that I estimated in my Merits Report, as indicated by Google's own documents.[280]

133. Despite his failure to engage in market definition, Dr. Gentzkow assumes that there is no separate antitrust product market for In-App Aftermarket services. Because tying requires two separate products, his failure to recognize that In-App Aftermarket services is a distinct market is tantamount to assuming the absence of any anticompetitive tie. As my Merits Report explains, standard antitrust economics shows that the In-App Aftermarket is one-sided because the derived demand for services in support of the purchase of In-App Content in the In-App Aftermarket lacks any indirect network effects. Matchmaking services are not present in the In-App Aftermarket, because the consumer and developer are already matched.[281]

134. Dr. Gentzkow claims incorrectly that my "market definitions and economic frameworks implicitly (and wrongly) assume" that Google would not "continue to set a positive service fee for transactions using alternative billing systems in the but-for world."[282] This is not an assumption of my analysis, but rather a result of it. Google's inability to extend its monopoly power into the In-App Aftermarket in a more competitive but-for world is a direct consequence of my analysis demonstrating that there exists as separate relevant product market for In-App Aftermarket services.[283] Consistent with standard antitrust practice, Dr. Gentzkow could have proposed an alternative market definition, but he did not, and instead claims that his conclusions are valid "under the market definition suggested by Plaintiffs."[284] This is nonsensical: If I am

275. Gentzkow Report ¶540-541.
276. Gentzkow Report ¶544.
277. Singer Merits Report ¶2.
278. Paddle, *In-App Purchase*, https://www.paddle.com/platform/in-app-purchase.
279. Singer Merits Report ¶324.
280. Singer Merits Report ¶322.
281. Singer Merits Report ¶144.
282. Gentzkow Report ¶550.
283. Singer Merits Report Part III.A. It is further confirmed by my analysis demonstrating that the so-called "Single Monopoly Profit" theory does not apply here. Singer Merits Report Part V.C.
284. Gentzkow Report ¶177.

correct in concluding that there is a separate In-App Aftermarket, then, under competition, Google would only be able to earn revenue in the In-App Aftermarket to the extent that it actually serves customers in the In-App Aftermarket.

135. Dr. Gentzkow claims "where[ver] Google has implemented or is planning to implement billing optionality for developers who were previously paying non-zero service fees, Google has also charged or is planning to charge a non-zero service fee for transactions using alternative billing systems."[285] This simply reflects Google's incentive and ability to replicate the In-App Aftermarket Tie-In in the actual world, given that it retains substantial monopoly power in the Android App Distribution Market. In a competitive but-for world, Google would not be able to charge a supracompetitive take rate for all sales of In-App Content in perpetuity. It is also possible that the alternative billing systems in Korea are providing only a subset of the services encompassed by the In-App Aftermarket. Similarly, the ONE store's decision to charge a (relatively modest) five percent take rate on transactions processed through alternative billing systems can be viewed as an economically rational response to Google's ability to charge a (substantially higher) take rate as high as 26% on transactions processed through alternative billing systems.[286]

136. Dr. Gentzkow claims that "[t]he fact that app developers including Epic have an interest in bypassing Google Play's billing system for certain in-app transactions does not provide evidence of a separate market; it simply reflects these app developers' incentive to free ride."[287] As I explained in my Merits Report, Google's own documents recognize numerous potential competitors in the In-App Aftermarket, which provides evidence of separate demand.[288]

137. In addition, various well-known Apps chose not to adopt Google Play Billing, including Hulu, Kindle, Netflix, and Tinder—even Google's own YouTube App.[289] That a Google-owned App would exhibit separate demand for In-App Aftermarket services shows that developers have separate demand for these aftermarket services; it would not make economic sense to claim that YouTube's separate demand reflects a desire to circumvent payments to Google. Record evidence indicates that GBP may be less efficient or convenient than alternative In-App Aftermarket service providers, providing a further basis for separate demand.[290]

138. Dr. Gentzkow claims that "developers are not actually coerced or required to use Google Play's billing system," because "developers are not required to use Google Play's billing system if they choose to monetize via means other than initial download fees or in-app purchases."[291] This is rather like an automobile monopolist asserting that dealerships are not "coerced" into purchasing cars at monopolistic prices because they may choose to sell a motorcycle instead. The question is not whether other monetization strategies exist, but rather whether a (not-so) hypothetical monopolist over the multibillion-dollar In-App Aftermarket could profitably raise

285. Gentzkow Report ¶554.
286. Wilson White, *Enabling alternative billing systems for users in South Korea*, Google Developers (Nov. 4, 2021), https://developers-kr.googleblog.com/2021/11/enabling-alternative-billing-in-korea-en.html.
287. Gentzkow Report ¶46.
288. Singer Merits Report ¶145.
289. Singer Merits Report ¶145.
290. Singer Merits Report ¶¶146-149.
291. Gentzkow Report ¶570.

prices significantly above competitive levels. My analysis of the relevant antitrust product market confirms that it could.

9. Dr. Gentzkow Fails to Demonstrate Other Challenged Conduct Is Procompetitive

a. Project Banyan

139. In my Merits Report, I explained that Google appears to have successfully discouraged Samsung from effectively competing with the Play Store, and that Google's efforts to do so included "Project Banyan."[292] Dr. Gentzkow claims that "Project Banyan was abandoned by Google and it never governed actual market transactions,"[293] and that "plaintiffs' experts provide no evidence that it impacted actual market competition[.]"[294] In fact, although record evidence indicated that Google "halt[ed] work" on Project Banyan in July 2019, it also establishes that Google's efforts to minimize competition from Samsung's Galaxy Store had already been effective.[295] Project Banyan worked in concert with other aspects of the Challenged Conduct, including Project Hug, to prevent Samsung from attracting a sufficient number of developers (and consumers) to compete effectively in the Android App Distribution Market.[296]

140. Project Banyan itself had no procompetitive justification. Project Banyan would have eliminated the Samsung Galaxy Store as a price competitor by distributing all apps on the Galaxy Store through Google Play.[297] Consolidating App store competition between the Play Store and the Galaxy Store would have had significant anticompetitive effects. Indeed, the record reflects that Google sought to eliminate the Galaxy Store in order to prevent price competition. An internal presentation at Google characterized Project Banyan as a "Critical Strategic Initiative" because "Google Play is facing increased competition from app store rivals" and "some partners are applying price pressure."[298]

b. App Campaigns

141. In my Merits Report, I explained that developers must list their Apps in the Play Store to access Google's App Campaigns program, which allows developers to place ads for Apps and In-App Content on Google's most valuable properties, including Google Search, YouTube, Discover on Google Search, and the Google Display Network. I explained that this conduct further entrenched Google's monopoly power in the Android App Distribution Market because developers

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292. Singer Merits Report ¶¶201-206.
293. Gentzkow Report ¶576.
294. Gentzkow Report ¶576.
295. Singer Merits Report ¶¶222-223.
296. Singer Merits Report ¶217.
297. Rosenberg Dep. 99:1-9 ("Q. What was Project Banyan? A. Project Banyan was a potential collaboration with Samsung that would kind of streamline the app discovery experience for users and the app distribution experience for developers. So it would – it would be creating a single flow for developers into Play that would hos the apps available to users on Samsung devices.")
298. GOOG-PLAY-010449493 at -497.

that did not list their Apps in the Play Store would risk losing advertising access to some of the Internet's most effective advertising space.[299]

142. Dr. Gentzkow claims that Google's App Campaigns are procompetitive because Google offers App Campaigns to developers in the Apple App Store.[300] Dr. Gentzkow is wrong. First, the Apple App Store is not part of the Android App Distribution Market. Second, that Google offers App Campaigns to developers in the Apple App Store (*outside* the Android ecosystem) undermines Dr. Gentzkow's claim that extending App Campaigns to other App stores *within* the Android ecosystem would be inefficient.[301]

c. Project Alley-Oop

143. In my Merits Report, I explained that Google may have secured a long-lasting commitment from [redacted] not to enter the Android App Distribution Market by leveraging the threat of [redacted]."[302] Although I did not opine on the existence of such an agreement, if the fact finder determines that Google and [redacted] did reach such an agreement,[303] it likely would have generated anticompetitive effects. Dr. Gentzkow does not challenge this conclusion.

144. My Merits Report also reviewed evidence that Google offered "Alley-Oop" [redacted] at significant cost to its own business, to disincentivize and slow [redacted]'s progress toward competing in third-party app distribution [redacted].[304] Dr. Gentzkow does not dispute that Alley-Oop [redacted][305] Nor does Dr. Gentzkow dispute that an agreement between the two companies to deter [redacted] from distributing Apps in competition with the Play Store would have had anticompetitive effects.

145. Instead, Dr. Gentzkow points to purported procompetitive benefits from Alley-Oop. Dr. Gentzkow asserts that, absent [redacted]

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299. Singer Merits Report ¶¶213-214.
300. Gentzkow Report ¶580.
301. Gentzkow Report ¶581.
302. Singer Merits Report ¶¶231-237.
303. Dr. Gentzkow cites a document indicating that [redacted] did "reject[]" Google's request for a contract that would have barred [redacted] from distributing third-party apps outside the Play Store while using Alley-Oop. GOOG-PLAY-002425286 at -287. I understand that at least one Google witness has given testimony consistent with the alleged agreement. Kochikar Dep. 425:18-22 ("Q. So at a certain point did [redacted] and Google come to an agreement regarding [redacted]? A Yes. [redacted] has agreed, I think, to focus more on the 1P and allow for Google solutions on 3P."). As explained in my Merits Report, Google documents and employee testimony indicate Google communicated to [redacted] that it planned to ask commitment from [redacted] not to distribute third-party apps at the conclusion of [redacted] Alley-Oop trial. *See* Singer Report ¶236; GOOG-PLAY-000083999; *see also* GOOG-PLAY-006367390 (June 29, 2017 email from Kirsten Rasanen explaining that [redacted] is "[w]illing to continue testing [redacted]"); *see also* Rasanen Dep. 204:9-16. To reiterate, I am not opining on the existence of the alleged agreement.
304. Singer Merits Report ¶¶231-237; GOOG-PLAY-011541267 ("In order to help [redacted] remain Play policy compliant, and avoid [redacted] performing direct installs, Play built a product called AlleyOop...").
305. Gentzkow Report ¶587. One Google employee assessed this [redacted]. GOOG-PLAY-007379918 (describing Alley-Oop [redacted] and hurting [Google's] own ad business").

[redacted] and into Google Play."[306] Yet the May 2015 document Dr. Gentzkow cites to characterize the pre-Alley-Oop [redacted] as "cumbersome" and "disjointed"[307] does not appear to be describing the experience of using [redacted] in particular, and more importantly, predates the experiments in [redacted] in 2016. As I explained in my Merits Report, it was the widespread [redacted], a process that circumvented the Play Store entirely, that Google evidently intended Alley-Oop [redacted][308]

146. I understand that [redacted] without the user having to leave the app, as Dr. Gentzkow himself later acknowledges—in apparent contradiction to his prior characterization of the user experience.[309] Consistent with this fact, I understand that [redacted] raised concerns about the efficiency of the *Alley-Oop* user experience in the course of negotiating over the use of Alley-Oop.[310] Dr. Gentzkow's primary procompetitive argument for Alley-Oop, therefore, appears to be based on a misunderstanding or mischaracterization of the technology Google sought to prevent.

147. Dr. Gentzkow's other procompetitive justifications for Alley-Oop fare no better. Dr. Gentzkow's claim that Alley-Oop benefitted small developers is wholly unsupported.[311] As Dr. Gentzkow acknowledges, and consistent with Google's apparent goal of preventing large developers such as [redacted] from building alternative app distribution mechanisms, Alley-Oop [redacted]—and it apparently has only ever been offered to these [redacted].[312] Google witness Kirsten Rasanen testified that she could only recall Google offering Alley-Oop [redacted]," and could only recall Google signing [redacted].[313] Dr. Gentzkow also

306. Gentzkow Report ¶586.
307. Gentzkow ¶588 (citing GOOG-PLAY-000578247.R).
308. Singer Merits Report ¶232, ¶235; GOOG-PLAY-007380405 at -411-12 (August 24, 2016 email from Paul Bankhead, who writes, "I think we all agree that it's really bad for the ecosystem and users for [redacted]. [T]he question is how best to structure Alley Oop [redacted] to avoid going down that path. . . . I think of this as negotiations with a country who wants to go nuclear. It's bad for the world. So we give them something they want in exchange for slowing or stopping development of their nuclear program. . . . If we give [redacted] alley Oop without getting an agreement for them to pause their [redacted], we aren't slowing them down at all.").
309. Gentzkow Report ¶593 ("[E]ven prior to implementing the Alley-Oop [redacted] was using copies of existing Google Play apps, and installing those directly on users' devices without Google Play enabling the install.").
310. Google employee emails indicate that, during negotiations, [redacted] complained that Google's Alley-Oop [redacted] harmed user experience because it introduced "[redacted].'" *See* GOOG-PLAY-007380405 at -413 (August 24, 2016 email from Kirsten Rasanen characterizing [redacted]'s "feedback on the overlay" to include that [redacted]'").]
311. Gentzkow ¶591.
312. Rasanen Dep. 227:12-228:2.
313. Rasanen Dep. 227:12-228:2.

fails to demonstrate that users benefitted from greater privacy or security by using the Play Store to install third-party apps via Alley-Oop [redacted].[314]

148. If the alleged agreement was in fact effective at incentivizing [redacted] in favor of funneling App installs through the Play Store, Google's and [redacted]'s own documents indicate it would have eliminated substantial potential competition in the Android App Distribution Market. As Dr. Gentzkow concedes, when [redacted] was launched in 2015, "indirect app discovery accounted for [redacted] percent of installs on Google Play."[315] In other words, nearly [redacted] of the Play Store's App installations came from advertisements and other sources that redirected users to the Play Store. In 2014, [redacted] of all indirect app installs on Play and approximately [redacted] percent of all App installs in the Play Store.[316] Another Google document confirms that [redacted] indirect App installs for Play in 2014, projected rapid future growth add-driven App installs generally, and noted that "[redacted] of the mobile app install market relative to its audience share."[317] In 2020, [redacted] estimated that it directed [redacted] through the Play Store, accounting for [redacted] percent of Play's install volume and $[redacted] in consumer spend.[318]

149. As illustrated below, Google's documents recognize that, as early as 2016, [redacted] was using app installation ads to build what was "essentially an app storefront":

314. Dr. Gentzkow cites no evidence regarding malware or privacy risks posed by [redacted]. Gentzkow Report ¶591. Record evidence indicates that Google looked for evidence that apps directly installed by [redacted] were more likely to be "Potentially Harmful Apps" (PHAs)—a term which, according to one Google employee, "roughly means malware"—and concluded on at least one occasion that "[redacted]." GOOG-PLAY-009261089 at -091-092.

315. Gentzkow Report ¶591, citing GOOG-PLAY-004728095.R -096.R. This document shows that indirect (deep linked) app discovery accounted for [redacted] percent of installs and [redacted] percent of Play revenue globally. In the U.S. the corresponding figures are [redacted] percent and [redacted] percent. *Id.* at -124.R.

316. GOOG-PLAY-004728095.R, at -129.R.

317. GOOG-PLAY-000103456.R at -463.R.

318. [redacted]_000015465, at 5-6.

FIGURE 6: [redacted]

[redacted]

Source: GOOG-PLAY-004697790.R at -817.R

150. In summary, to the extent Google managed to incentivize [redacted] to slow or halt its entry into the Android App Distribution Market, this likely had significant anticompetitive effects on consumers, particularly given the competitive potential of a firm with [redacted] resources, experience, and technological expertise. To date, [redacted] has yet to deploy a competing App store, or significantly engage in direct install of third-party apps; the evidence indicates that [redacted] is using a version of Google's Alley-Oop [redacted].[319]

C. Dr. Gentzkow Ignores Standard Antitrust Principles

1. Dr. Gentzkow's Conclusion That "Competition Has Not Been Foreclosed" Does Not Follow From Standard Antitrust Principles

151. Although Dr. Gentzkow purports to demonstrate that "competition has not been foreclosed,"[320] his analysis of foreclosure is not grounded in standard antitrust economics. According to Dr. Gentzkow, the Challenged Conduct does not constitute anticompetitive foreclosure because it has not entirely eliminated "users' and app developers *access* to alternative means of interacting [outside of the Play Store]."[321] Dr. Gentzkow's standards for establishing "access" are not grounded in standard economics and are so lenient that they would preclude

319. Dr. Gentzkow implicitly concedes this. Gentzkow Report ¶596 ("[redacted] continues to explore developing an Android app store."); Karam Dep. 180:2-8 (confirming that [redacted] "currently uses a version of [redacted] for a percentage of traffic").

320. Gentzkow Report Part VI.

321. Gentzkow Report ¶178.

antitrust intervention in virtually any real-world high-tech platform market. Antitrust economists recognize that anticompetitive foreclosure "totally *or partially*" denies competitors from access to "critical inputs or customers."[322] Rivals need not be completely excluded from the market; anticompetitive harm occurs when rivals remain in the market but their ability to impose competitive discipline is compromised.[323] Conduct that makes rivals less efficient makes them less competitive. But if Dr. Gentzkow is to be believed, evidence of "access" through virtually any alternative, no matter how inferior or inefficient, is proof that foreclosure could not have occurred.

152. For example, Dr. Gentzkow portrays the fact that the Samsung Galaxy Store is (for some users) "literally a click away"[324] as evidence of robust competition. But as I explained in my Merits Report, Google discouraged Samsung from effectively competing with the Play Store and entered into deals with developers (such as Google's sim-ship agreements) to mitigate the risk of competition from Samsung.[325] As Dr. Gentzkow correctly observes, Samsung's headline take rate is 30 percent—no different than the Play Store's.[326] This reflects Samsung's inability (or unwillingness) to compete effectively—as does Samsung's failure to announce even modest take rate reductions in response those that Google has implemented for small developers and subscription developers. As a consequence, despite being "a click away" for users of Samsung devices, the Samsung Galaxy Store accounts for only [redacted] percent of visits and time spent on OEM App stores,[327] and the number[328] and quality[329] of Apps on the Samsung Galaxy Store is [redacted].[330] Dr. Gentzkow himself presents data showing that, even among users of Samsung devices, U.S. consumer expenditure in the Galaxy Store is about [redacted] percent of that in the Play Store.[331] In Exhibit 14 of his report, Dr. Gentzkow presents the "Share of GMS Devices with a Preinstalled App Store," but the vast majority of these are [redacted] devices with the [redacted], as seen below. Aside from [redacted] the remaining OEMs with preinstalled App Stores are overwhelmingly Chinese OEMs, which do not have significant individual reach to compete with the Play Store.

322. Steven Salop, *The Raising Rivals' Cost Foreclosure Paradigm, Conditional Pricing Practices, and the Flawed Incremental Price-Cost Test* 81(2) ANTITRUST LAW JOURNAL 371, 376 (2017) (emphasis added).

323. *Id.* at 377.

324. Gentzkow Report ¶31.

325. Singer Merits Report ¶¶201-207.

326. Gentzkow Exhibit 10.

327. Singer Merits Report ¶¶125-126; Figures 8-9.

328. Gentzkow Report Exhibit 27 (showing 191,128 Apps available in Samsung Galaxy Store, compared with over 3.2 million in the Play Store).

329. Singer Merits Report ¶131; Table 3 (as of mid-2022, only eight of the top 20 most-downloaded Play Store Apps were also available in the Galaxy Store).

330. Singer Merits Report ¶170; Figure 12.

331. Gentzkow Report Exhibit 26 (showing, for [redacted] devices, average annual spend of $[redacted] per user per device in the [redacted], compared with $[redacted] in the Play Store).

FIGURE 7: SHARE OF GMS DEVICES WITH PREINSTALLED OEM APP STORE

[redacted]

Sources: "OEM Footprint Data (2015-2021)"; GOOG-PLAY-010801683; Gentzkow workpapers.

153. Dr. Gentzkow interprets the trivial penetration of the Amazon Appstore—installed on less than [redacted] percent of active Android devices[332]—as evidence that competition was not foreclosed.[333] Google has deployed multiple measures in the OEM channel,[334] in addition to technical barriers,[335] to ensure that Amazon would not become an effective competitor.[336] The Amazon Appstore's inability to gain traction is remarkable in light of the fact that it offers [redacted] consumer subsidies than Google on Google Android devices (almost [redacted] percent),[337] as well as offering a [redacted].[338]

332. Singer Merits Report Table 4.
333. Gentzkow Report ¶181.
334. Singer Merits Report Part IV.A.2.b.
335. Singer Merits Report Part IV.A.4.
336. Dr. Gentzkow also does not dispute any of my calculations showing that alternative App stores account for at most a trivial fraction of the Android App Distribution Market. Singer Merits Report Part II.C.2.a.
337. Singer Merits Report ¶313; ¶417.
338. [redacted]

154. The same data that Dr. Gentzkow cites to argue for the prevalence of competition in fact demonstrates the [redacted] penetration of Amazon's App store:

FIGURE 8: SHARE OF GMS DEVICES WITH A PREINSTALLED AMAZON APP STORE

[redacted]

Source: GOOG-PLAY-010801683. The orange line contains the share of devices with Amazon package names [redacted]. The gray line contains the share of devices with "[redacted]". At some points in time the "[redacted]" may have included the [redacted], while at others it did not.

155. [redacted]

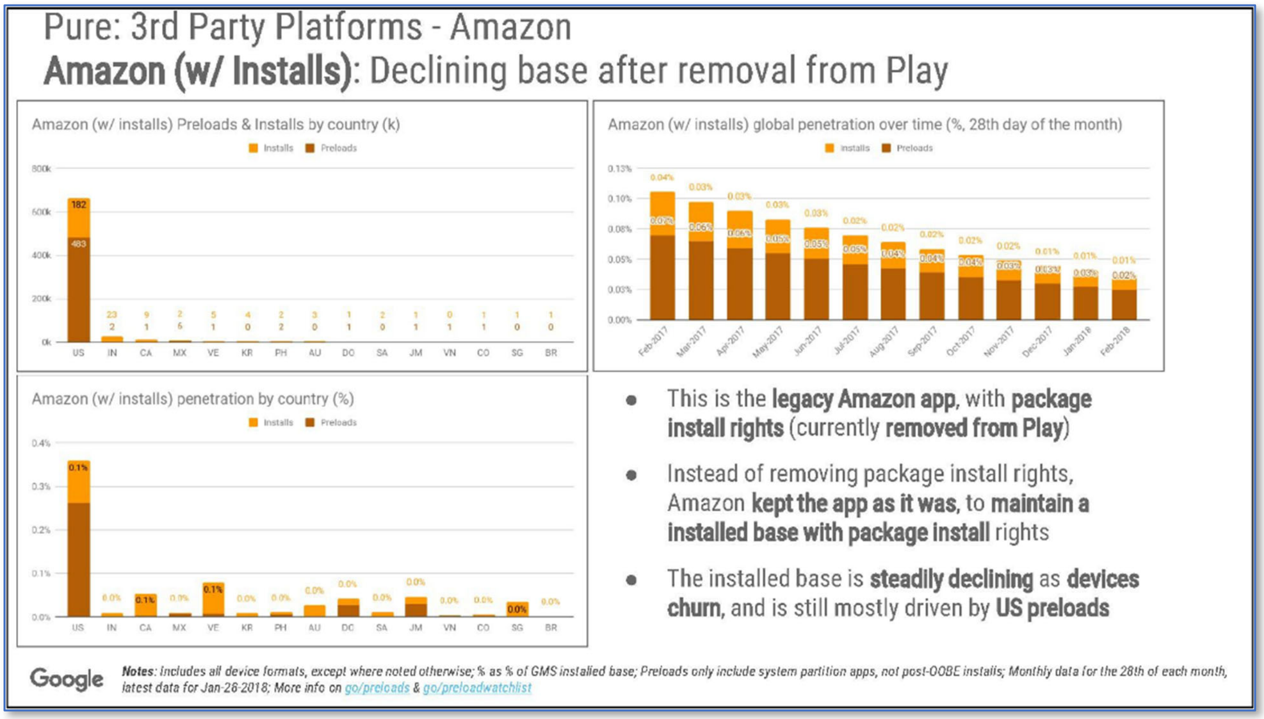
156. As shown below, Google's own analysis from 2018 shows an even lower percentage of GMS devices with the Amazon Appstore. After being removed from Play, the

339. [redacted]

340. AMZ-GP_00005705.

"Amazon (w/ Installs)" app declined to 0.03 percent global penetration (0.02 percent from preloads and 0.01 percent from installs).[341]

FIGURE 9: AMAZON APPSTORE'S SMALL AND DECLINING PENETRATION



Source: GOOG-PLAY-006381392.R at -406.R

157. Record evidence indicates one reason for this trivial penetration was pressure from Google. [redacted][342] Jamie Rosenberg confirmed that Google talked with [redacted]."[343]

158. The record includes numerous examples of Google pressuring OEMs not to preload the Amazon Appstore. In 2014, a Google employee recommended not approving a Dell tablet specifically because it preloaded the Amazon Appstore.[344] In 2015, Google rejected a request from Lenovo to preload Amazon's App store on apparently non-AFA-compliant devices: "If they had not signed the AFA, they could do whatever they want. But they can't sign it and then want the benefit of shipping non-compliant devices with 3rd party app stores… it would also result in

341. GOOG-PLAY-006381392.R at -406.R.
342. Morrill Dep. 123:20-125:24 (discussing PX 1361 - AMZ-GP_00003314); 184:20-186:11.
343. Rosenberg Dep. 62:14-64:3.
344. GOOG-PLAY-009911757 ("My two cents – Even though this is not a MADA violation, I would recommend not approving this device with the Amazon App store on it.").

Amazon encouraging our partners to ship non-compliant devices because they could shoe-horn in their app store in place of ours."[345]

159. Record evidence also indicates that Google's revenue sharing arrangements with carriers were intended to pressure them not to preload Amazon's App store. In 2011, when a Google employee expressed concern that competitive App stores Cisco and Amazon were giving developers a greater than 70% revenue share, Andy Rubin asked, "How do you think they are going to get distribution when we give the carriers 30%?"[346]

160. Although Google reduced its revenue shares in later years, record evidence indicates that Google was reluctant to completely eliminate revenue share payments to carriers because they were "insurance that carriers will not adjust preset prime placement of . . . [the] play store."[347] As recently as 2019, Google expressed concern that cancellation of the carrier agreements could lead to mobile devices being sold with "an alternative App store [e.g. Amazon Underground]," and that, if "alternative app stores became a viable distribution channel for apps …**Play revenue will be at risk and the MADA would come under pressure**."[348] Google expressed concern that "[c]arriers would configure Android devices in a way most profitable to them," through these "alternative app stores."[349]

161. Dr. Gentzkow does not dispute my finding that the Play Store accounts for the vast majority of App installs and updates on Google Android devices,[350] even when one charitably includes installs and updates through peer-to-peer ("P2P") Apps such as ShareIt, which can be used for sideloading.[351] As detailed below, the record evidence indicates that P2P App distribution generally serves as a complement rather than a substitute for the Play Store, and that Google has reached agreements to cooperate with P2P Apps and to collect its take rate on consumer expenditures through Apps distributed via P2P. Dr. Gentzkow is incorrect to claim that "access" to P2P Apps provides proof that foreclosure has not occurred in the Android App Distribution Market.

162. Record evidence indicates that P2P Apps serve as a complement to the Play Store: According to Google documents, Google determined that users turned to P2P Apps when they had limited access to data, particularly in emerging markets.[352] Google has also found that sideloading in India most frequently occurred via [redacted], and that of the "[redacted]% of users [who] use sideloading as their primary app acquisition channel," "[redacted]% use Google Play as their secondary source of app[s]."[353] Consistent with P2P's complementary role, in 2018 Google announced a partnership with ShareIt and other P2P Apps in which "Play [would] be able to determine shared app

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345. GOOG-PLAY-000451508, GOOG-PLAY-000451520.
346. GOOG-PLAY-001547487 at -488.
347. GOOG-PLAY-004541676 at -678.
348. GOOG-PLAY-004235359 at -360 (emphasis in original).
349. *Id.*
350. Singer Merits Report ¶¶127-128; Table 1.
351. *See* GOOG-PLAY-000399013 at -13-14 (2016 document describing P2P as "the most common method of sideloading" and explaining it is most prevalent in "India Tier 1 cities," with ShareIt being the most common App).
352. *See* GOOG-PLAY-000399013 at -13 ("In most emerging markets data is slow and expensive, so users look for ways to acquire apps without using data, i.e., they sideload apps outside the Play Store.").
353. *Id.* at 13-14.

authenticity while a device is offline, add those shared apps to a user's Play Library, and manage app updates when the device comes back online."[354] Google would face clear economic incentives to enter into such agreements if it were able to collect a take rate on Apps distributed via P2P, and record evidence indicates that it does.[355]

163. In Exhibit 16 of his report, Dr. Gentzkow presents the "Number of App Installations from Alternative Sources," but neglects to compare it with the number of App installations via the Play Store. As shown below, Play accounts for the vast majority of App installations.

354. *See* James Bender, *Google Play offline peer to peer installs beta*, Android Developers Blog (Oct. 19, 2018), https://android-developers.googleblog.com/2018/10/offline-p2p-installs-beta.html; *see also* GOOG-PLAY-000791152 at -153 ("Play Offline P2P meets our users in places where they are already are--in ShareIt, Xender, and FilesGo. Our partner apps are predominantly used in emerging markets when connections are spotty or slow or where a friend or family member can P2P a great app recommendation."). Google also reached agreements with these Apps to provide them with Google-developed APIs; the contracts allowed Google to "literally terminate the service for any individual (or all) partner[s] at any time." GOOG-PLAY-001026503.

355. For example, record evidence indicates ShareIt was distributing the same versions of the Apps distributed through the Play Store, and the Play Store was adopting those apps, including "add[ing] those shared apps to a user's Play Library, and manag[ing] app updates when the device comes back online." James Bender, *Google Play offline peer to peer installs beta*, Android Developers Blog (Oct. 19, 2018), https://android-developers.googleblog.com/2018/10/offline-p2p-installs-beta.html. Once Play has adopted an App in the Play Library, it receives its standard take rate. *See* GOOG-PLAY-004694345 at -5217 ("Play-blessed P2P sharing of apps fully in production, leading to ~1M additional Play acquisitions per day!").

FIGURE 10: APP INSTALLS BY SOURCE ON GOOGLE ANDROID DEVICES

Sources: GOOG-PLAY-000808464; Gentzkow workpapers

164. In my Merits Report, I explained that Google's most recent series of OEM agreements provide OEMs with additional economic incentives not to compete in App distribution in exchange for payments from Google.[356] These new RSAs (known as the Google Distribution on Android Framework ("GDAF", "Google Forward," or "RSA 3") build on Google's MADA restrictions to further foreclose competition in the Android App Distribution Market. These contracts explicitly prohibit OEMs from pre-installing competing third-party App stores (or other third-party Apps that compete with Google Apps) on "Premier" devices.[357] In exchange, OEMs receive "Premier Tier" revenue share payments—including Search revenue.[358] Google is therefore

356. Singer Merits Report ¶¶208-211.

357. *See, e.g.,* GOOG-PLAY-000620210 at -221 (RSA with Vivo, a Chinese OEM, specifying that "Company will not and will not allow any third party to do any of the following with respect to Premier Devices…include in any manner on a Premier Device…an Alternative Service…"). *Id.* at -212 (defining "Alternative Service" to include "Alternative Play Service," , which "means any service that is substantially similar to Google Play (as determined by Google in its sole discretion)"). *See also* GOOG-PLAY-001745614 at -625 (RSA with HMD, the Finnish OEM that manufactures Nokia devices, with comparable provisions); GOOG-PLAY-000416651 at -662 (similar contract with OEM OnePlus); GOOG-PLAY-000620638 at -649 (similar contract with OEM Xiaomi); GOOG-PLAY-001745614 at -625 (similar contract with OEM Oppo).

358. *See, e.g.,* GOOG-PLAY-000443763.R at -3775.R (Describing [redacted] as offering "[u]p to [redacted] that preload Play as the exclusive app store on devices.") *Id.* at -3769.R (Describing RSA as "[redacted][.]"). *See also* GOOG-PLAY-004494430.C at -4443.C (2016 slide deck proposing that Google "[redacted] in exchange for a clean

leveraging its dominance in Search to bolster the effectiveness of its anticompetitive exclusionary conduct in the Android App Distribution Market.

165. Dr. Gentzkow attempts to minimize the importance of these contracts, claiming that "Premier Tier provisions have never affected more than a small share of Android devices," because "Premier Tier provisions applied to only [redacted] percent of all active GMS devices worldwide (excluding China)[.]"[359] In presenting this statistic, Dr. Gentzkow ignores at least two economically significant facts. *First*, the Premier Tier accounts for a much higher share of new device activations. As seen below, by 2022, about [redacted] percent of new device applications worldwide (excluding China) have been subject to these contracts in 2022. By August 2022, over [redacted] *percent* of new device activations were subject to the Premier Tier and were therefore prohibited from preloading competing App stores. Record evidence indicates Google expects that that the full effect of its Premier Tier contracts will not be reflected in the market until sometime in [redacted], indicating that an even higher share of Google Android devices will likely be subject to these exclusive contracts.[360]

'Nexus-like' experience," including "No competing platforms (e.g., alternate app stores.")). Nexus is the brand name previously used for smartphones made by Google. *See, e.g.,* Jessica Dolcourt, *Google Nexus 6P review: Best-ever Nexus sets new standard for big-screen Android value*, CNET (Jul. 19, 2016), https://www.cnet.com/reviews/google-nexus-6p-review/.

359. Gentzkow Report ¶396.

360. GOOG-PLAY4-004260189 at -190.

FIGURE 11: SHARE OF NEW DEVICE ACTIVATIONS SUBJECT TO RSA 3 PREMIER TIER WORLDWIDE (EXCLUDING CHINA)

[redacted]

Source: GOOG-PLAY-011657415.xlsx, GOOG-PLAY-011657416.xlsx, GOOG-PLAY-011657417.xlsx, GOOG-PLAY-011657418.xlsx, GOOG-PLAY-011657419.xlsx, GOOG-PLAY-011657420.xlsx, GOOG-PLAY-011657421.xlsx, GOOG-PLAY-011657422.xlsx, GOOG-PLAY-011657423.xlsx, and GOOG-PLAY-011657424.xlsx. [redacted]”. Samsung devices were identified by records in which manufacturerbrand == “Samsung”. Pixel devices were identified by records in which manufacturerbrand== “Google”.

166. *Second*, the Premier Tier accounts for an even higher share of new activations among devices manufactured by Chinese OEMs and sold outside of China. The data underlying Figure 1 above show that the share of new Chinese OEM device activations subject to these contracts [redacted].[361] Many OEMs based in China, including Huawei, Xiaomi, Vivo and Oppo, have expanded their footprint beyond China itself.[362] As Google’s documents recognize, Chinese OEMs have increasingly been loading

361. *See* GOOG-PLAY-011657415-GOOG-PLAY-011657425 (“Device Activations Data”).
362. Singer Merits Report ¶11.

competing App stores on the devices they manufacture, posing a potential competitive threat to the Play Store.[363]

167. Record evidence shows that Google has rapidly rolled out Premier Tier RSAs to ward off the emergence of new potential competition on the growing share of devices outside of China produced by Chinese OEMs. According to the same document, [redacted].”[364] The Executive Summary explains “We are fine-tuning [redacted] to protect Google from key strategic risks,”[365] and describes “[o]ffer[ing] [redacted] . . . to secure Play exclusivity….”[366]

168. The Premier Tier RSAs therefore complement other aspects of the Challenged Conduct that have successfully suppressed competition in the Android App Distribution Market. As explained in my Merits Report, Google deployed the MADAs to ensure that the Play Store received prominent placement on every single GMS device,[367] and deployed Project Hug to secure content from some of the largest developers, preventing them from giving competing stores the exclusive content necessary to help drive usage, and by imposing content parity requirements on certain developers, all of which impaired entry and expansion by competing App stores.[368] [redacted] “protects against Play risk with OEMs, complementing Hug and Banyan.”[369] Record evidence indicates that Google was willing to invest substantial resources to protect its market power. As of 2019, Google expected to make [redacted].[370] Google also expected to make payments on the order of $[redacted].[371]

2. Dr. Gentzkow Ignores the Coordinated Nature and Effects of the Challenged Conduct

169. In my Merits Report, I demonstrated how the Challenged Conduct allowed Google, through coordinated and mutually reinforcing conduct, to amass monopoly power and to engage in anticompetitive conduct harmful to Consumer Plaintiffs. Antitrust economists recognize that

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363. GOOG-PLAY4-004260189, at -222. *Id.* at -193 (“Since 2016, ecosystem dynamics have changed and competition has increased. Gaps in coverage exist. . . . Chinese OEMs have alternative stores preloaded on [redacted]% of Android devices, and have a meaningful overlap with Play offering[.]”)

364. GOOG-PLAY4-004260189 at -199.

365. GOOG-PLAY4-004260189 at -190.

366. GOOG-PLAY4-004260189 at -190. *Id.* at -195 (specifying “[redacted]% Play revenue share…for [redacted]; [redacted]%-[redacted]% for [redacted][.]”) *Id.* at -198 (“How are we spending the $[redacted] in 2023: [redacted],” specifying $[redacted] million in revenue sharing on [redacted], comprised of $[redacted]).

367. Signer Merits Report ¶¶194-197.

368. Singer Merits Report ¶¶215-230.

369. GOOG-PLAY4-004260189, at -206 (“GDAF’s Google Forward Tier protects against Play risk with OEMs, complementing Hug and Banyan.”)

370. GOOG-PLAY4-004260189 at -207.

371. GOOG-PLAY4-004260189 at -207 (showing “2023 Steady State Revenue Share” between $[redacted] to OEMs).

anticompetitive conduct among high-tech platforms typically involves mutually reinforcing strategies, reinforced by network effects and incumbency advantage.[372] Record evidence indicates that Google itself recognized the coordinated nature and effects of the Challenged Conduct.[373]

170. Despite this well-understood phenomenon, Dr. Gentzkow evaluates the Challenged Conduct piecemeal. For example, Dr. Gentzkow evaluates Google's early RSAs[374] separately from the later RSAs.[375] But as I explained in my Merits Report, both the early and the late RSAs were part of a long-term strategy that allowed Google to achieve dominance and engage in anticompetitive exclusionary conduct in the Android App Distribution Market.[376] More broadly, Google's substantial foreclosure of the Android App Distribution Market was the combined result of different elements of the Challenged Conduct, including the RSAs, Google's exclusionary restraints on OEMs, Project Hug, Google's technical restrictions, and other conduct detailed in my Merits Report.[377] The collective effect of this conduct was to deprive would-be rivals of the ability to compete effectively with the Play Store.

3. Dr. Gentzkow's "Fragmentation" Defense Is Without Merit

171. Dr. Gentzkow claims that the Challenged Conduct was necessary to prevent what he terms "device fragmentation"[378] and "app store fragmentation."[379] According to Dr. Gentzkow, device fragmentation occurs when "the devices in the ecosystem are incompatible or only partly compatible with each other,"[380] and app store fragmentation occurs "when no app store(s) contain a comprehensive set of apps and many app stores are accessible only to certain groups of users."[381]

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372. *See, e.g.,* Singer Merits Report ¶29; ¶82; ¶88; ¶¶135-136; ¶¶187-188; *see also* Athey & Scott Morton (2022) at 679 ("Platform annexation disrupts multi-homing by steering users to its platform and away from platforms of rivals. When a large platform deprives a smaller rival of participants on either side of the market, it reduces the competitiveness of the smaller platform (or deters entry by new, smaller platforms) and thus lessens the competitive pressure on itself. This advantage is often self-reinforcing because it generates further concentration of activity in the larger platform and marginalization or exit of the small platform. This kind of feedback loop often characterizes multi-sided platforms more than "old economy" businesses. And the feedback loop increases the efficacy of the platform's strategy, enabling it to increase its profits and reduce welfare for platform constituents in the short and long run.").

373. *See, e.g.,* GOOG-PLAY-000565846; GOOG-PLAY-001265881; GOOG-PLAY-004708826; GOOG-PLAY-000005029; GOOG-PLAY-000879069; GOOG-PLAY-001265881; GOOG-PLAY-000463493.

374. Gentzkow Report Part IX.

375. Gentzkow Report Part X.

376. Singer Merits Report Part IV.A.

377. Singer Merits Report Part IV.B.

378. Gentzkow Report ¶104.

379. Gentzkow Report ¶105.

380. Gentzkow Report ¶104 ("Fragmentation on a smart device platform such as Android takes many forms, of which two are particularly relevant. The first is what I will refer to as device fragmentation. This does not refer to having a large number of devices in the ecosystem; fragmentation does not increase just because more device makers enter, existing device makers become more successful, and/or the market becomes more competitive. Rather, device fragmentation refers to a situation in which the devices in the ecosystem are incompatible or only partly compatible with each other—i.e., they do not share a common baseline set of core capabilities and features that app developers rely on.").

381. Gentzkow Report ¶105 ("The second form is app store fragmentation. This does not refer to having a large number of app stores in the ecosystem; fragmentation does not increase just because more app stores enter, existing app stores become more successful, and/or app distribution becomes more competitive. Rather, app store fragmentation occurs when no app store(s) contain a comprehensive set of apps and many app stores are accessible only to certain groups of users.").

According to Dr. Gentzkow, fragmentation "can effectively split a single platform into separate sub-platforms."[382]

172. Dr. Gentzkow is incorrect to assume that a more competitive but-for world would be characterized by harmful fragmentation. Dr. Gentzkow provides no evidence that what he calls "app store fragmentation" is harmful; as explained below, Dr. Gentzkow incorrectly conflates fragmentation in App distribution with mobile OS fragmentation. As Dr. Gentzkow concedes, "fragmentation does not increase just because more app stores enter, existing app stores become more successful, and/or app distribution becomes more competitive."[383] I agree with Dr. Gentzkow that entry and/or expansion by App distribution rivals such as the Amazon Appstore—the key driver of competition in the Android App Distribution Market in a more competitive but-for world—does not imply increased fragmentation.

173. Increased competition from the Amazon Appstore (and/or other App distribution rivals) does not imply that "no app store(s) [would] contain a comprehensive set of apps and many app stores [would be] accessible only to certain groups of users."[384] Due to indirect network effects, rival App stores would need to attract as many developers and users as possible in order to compete successfully.[385] For example, a rival App store that could "only be accessed by [a single] OEM's or MNO's users,"[386] as Dr. Gentzkow suggests, would be at a distinct competitive disadvantage. It would be less attractive to developers because the size of its user base would be constrained; this would discourage developers from distributing their Apps through the App store, making it less attractive to users. I understand that Professor Schmidt has found that the technical barriers to developing Apps capable of functioning in multiple Android App stores are modest. And a competing App store would face clear economic incentives to minimize any incremental costs associated with making their Apps available on that store.

174. Dr. Gentzkow provides no evidence or any convincing economic rationale as to why limited App exclusives by emerging competitors to Google Play would harm the Android ecosystem. Elsewhere in his report, Dr. Gentzkow defends deals for exclusive distribution of products as indicative of "competition on the merits."[387] Google documents recognize that App stores securing exclusives could enhance competition in the Android App Distribution Market.[388]

175. Dr. Gentzkow incorrectly conflates fragmentation in App distribution with mobile OS fragmentation. Dr. Gentzkow offers examples of older industries (fax systems, quadraphonic sound, 56kbps modems, and the UNIX operating system) in which industry participants failed to

382. Gentzkow Report ¶103.
383. Gentzkow Report ¶105.
384. Gentzkow Report ¶105.
385. Singer Merits Report ¶24; ¶82. Dr. Gentzkow agrees that there are substantial indirect network effects. Gentzkow Report ¶74.
386. Gentzkow Report ¶105.
387. Gentzkow Report ¶377.
388. Singer Merits Report Part IV.A.3.b; *see* GOOG-PLAY-007814830.R at -835.R-836.R (explaining that the "loss of top developers...to competitors...would significantly impact Play's business" and that competitor app stores including the Galaxy Store and the Epic Games Store are "[a]ggressively [p]ursuing [g]aming" in part by pursuing exclusive content); *id.* at -858.R (explaining, "Losses start out small, but can grow quickly once competitors gain traction," and that the model of revenue risk in 2019 assumes a "couple of partial exclusives off-play [are] expected to occur").

adopt compatible technology standards, and incorrectly presents it as evidence that the Android App Distribution Market would become fragmented in the but-for world.[389] Dr. Gentzkow misunderstands the Challenged Conduct, which impaired competition within Google Android, as opposed to competition across different mobile operating systems. A competing App store does not need to saddle users with a new mobile OS; as Dr. Gentzkow concedes, it can be "just a click away[.]"[390] Users may have dozens of Apps on their devices (all "just a click away"), including competing Apps such as Uber and Lyft, but this does not imply that the Android ecosystem is fragmented. As explained above, I understand the technical barriers deploying Apps that would be cross-compatible with different Google Android App stores are modest. In a more competitive but-for world, competing App stores would face clear economic incentives to attract developers by minimizing any incremental costs to developers associated with adding more Apps to their stores.

176. Dr. Gentzkow continues to incorrectly conflate fragmentation in App distribution with mobile OS fragmentation when he emphasizes the failure of Symbian, a discontinued mobile OS.[391] The evidence reviewed by Dr. Gentzkow indicates that Symbian made ill-advised business decisions in the design of its mobile OS, with "mutually incompatible user interfaces,"[392] frustrating the development of indirect network effects within the Symbian OS. Economists have observed that "[t]he way [Symbian] was constructed meant that its software providers couldn't introduce the sorts of innovations that were driving the personal computer and web economies."[393] None of the evidence reviewed by Dr. Gentzkow establishes that so-called "app store fragmentation" contributed to Symbian's failure. The but-for world would entail increased competition within the Android App Distribution Market on Google Android devices, not mutually incompatible interfaces.

4. Dr. Gentzkow Incorrectly Assumes That All Improvements in Output and Quality Are Attributable to the Challenged Conduct

177. Increasing output and improvements in quality over time are the norm for computerized technology markets.[394] But when Dr. Gentzkow observes similar trends in this case, he incorrectly infers that the Challenged Conduct must have been procompetitive.[395] Dr. Gentzkow provides no evidence that the Challenged Conduct caused any of these trends.

178. In Exhibit 2 of his report, Dr. Gentzkow observes that the quantity of Android smartphones sold has increased over time, along with the number of app downloads, the number

389. Gentzkow Report ¶107.
390. Gentzkow Report ¶31.
391. Gentzkow Report ¶¶110-113.
392. Gentzkow Report ¶111.
393. David S. Evans and Richard Schmalensee, Matchmakers: The New Economics of Multisided Platforms, (Harvard Business Review Press 2016) at 111.
394. *See, e.g.,* Ernst Berndt & Neal Rappaport, *Price and Quality of Desktop and Mobile Personal Computers: A Quarter- Century Historical Overview* 91(2) AMERICAN ECONOMIC REVIEW 268 (2001).
395. Gentzkow Report ¶155 ("The broad trends documented in this section suggest that Google has succeeded in addressing the core collective action problems on Android and creating a thriving ecosystem that generates tremendous value for users, app developers, and other platform participants. Output and quality have increased dramatically while prices have fallen or remained stable.").

of new apps available, and the revenues of app developers. Dr. Gentzkow makes no attempt to demonstrate that any of these trends were caused by the Challenged Conduct. In my Merits Report, I showed that output in the Android App Distribution Market and the In-App Aftermarket would have increased by approximately 25 percent in the but-for world.[396]

179. In Exhibit 3 of his report, Dr. Gentzkow displays data indicating that "average prices for Android smartphones are relatively low and have fallen over time,"[397] and notes that "[t]his contrasts with prices for iOS smartphones which are higher and have been increasing."[398] This is consistent with my Merits Report, in which I observed that "distinct pricing and features" is one of the factors that helps to insulate iOS and Google Android from head-to-head competition.[399] Dr. Gentzkow provides no convincing evidence that observed trends in the average price of Android smartphones are caused by the Challenged Conduct. Nor does he address the fact that prices of other consumer technologies have fallen by as much or more than Android smartphones.[400] By Dr. Gentzkow's logic, this evidence would suggest that the Challenged Conduct may have caused the price of Android smartphones to decline by less than they would have otherwise.

180. In Exhibit 4 of his report, Dr. Gentzkow displays the (simple) average take rate paid by U.S. developers and emphasizes a decline in the (simple) average take rate at the end of the Class Period. This metric is misleading because it does not reflect the portion of developer revenue that Google retains in the aggregate. A more meaningful measure of Google's pricing is the weighted average take rate for all U.S. transactions, shown in Figure 12. As seen below, the weighted average take rate for non-subscription developers has remained fixed at almost exactly 30 percent for the majority of the Class Period; it has fallen irregularly since mid-2021, landing at 28 percent in May 2022. When subscription developers are included, the weighted average take rate is fixed between 29 and 30 percent for the majority of the Class Period; it has fallen irregularly since mid-2021, landing at 26 percent in May 2022. Google's weighted average take rate has consistently remained far above the competitive level of approximately 15 percent.

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396. Singer Merits Report ¶398, Figure 20. Dr. Gentzkow does not specifically critique my but-for output analysis, except to the extent that he claims (incorrectly) that my economic models assume their conclusions. Gentzkow Report ¶599.

397. Gentzkow Report ¶161.

398. Gentzkow Report ¶161.

399. Singer Merits Report Part I.A.1.b.

400. For example, according to the Bureau of Labor Statistics, the price of televisions declined by approximately 75 percent from 2008 through 2015. *See, e.g.,* https://www.bls.gov/opub/ted/2015/long-term-price-trends-for-computers-tvs-and-related-items.htm

FIGURE 12: GOOGLE PLAY WEIGHTED AVERAGE TAKE RATE
(US TRANSACTIONS, AUGUST 2016-MAY 2022)

[redacted]

Source: Google Transaction Data.

181. In Exhibit 10 of his report, Dr. Gentzkow presents what he terms "Standard Service Fees for Major Mobile App Stores." In Exhibit 11, he presents "Service Fees for Other Selected Platforms." In Appendix 5, I review the various benchmarks offered by each of the Google Experts and I explain why they are unpersuasive.

D. Dr. Gentzkow Fails to Demonstrate That Consumer Plaintiffs Have Not Suffered Antitrust Injury Resulting From Google's Anticompetitive Conduct, or that Consumer Plaintiffs "Would Likely Be Worse Off" Absent The Challenged Conduct

182. Dr. Gentzkow claims that "consumers would plausibly be *worse off* in a but-for world where the challenged conduct was absent."[401] Dr. Gentzkow speculates on what he views as various potential consequences of "reducing or eliminating Google's ability to monetize its investments" in the but-for world, but does not opine on the likelihood or extent of any given outcome.[402] As I have explained, Google would remain highly profitable in the but-for world,[403]

401. Gentzkow Report ¶635.
402. Gentzkow Report ¶637.
403. Singer Merits Report Part VI.H.

and increased competition in the but-for world would not cause Google to offset the lost revenue by charging even a modest fee on consumers, or by taking other measures to cut costs by reducing the scope, quality, or security of services provided by the Play Store.[404] To the contrary, lower prices would result in increased output;[405] consumers would also have benefitted further from enhancements to output, quality, and consumer choice in a more competitive but-for world.[406]

183. Like other Google Experts, Dr. Gentzkow claims that the Chinese market illustrates the perils of the but-for world. As explained in Part I.D above, Dr. Gentzkow and the Google Experts do not acknowledge the limits of intellectual property protection and the widespread practice of App scraping in the Chinese ecosystem, which together limit App developers' ability to command more favorable take rates. They also ignore the considerable regulatory burdens and the associated costs for Chinese app stores.

184. Dr. Gentzkow asserts that the Challenged Conduct has produced "enormous benefits" for Google to coordinate with other firms and that such coordination can be explained away as solving a collective action problem.[407] This is inconsistent with standard antitrust economics. When it comes to competing for App store distribution, OEMs and the mobile operators should be understood as potential horizontal competitors to Google. Antitrust prevents horizontal rivals (and would-be rivals) from coordinating because of the natural conflict between the rivals' joint interests (higher prices, lower output) and consumers' interests (lower prices, higher output). By contrast, antitrust law shows deference to firms that coordinate decision-making inside the firm's boundaries. For example, in the DC Circuit's opinion in *Microsoft*, interference with product design was rejected out of deference to Microsoft's business judgment.[408] It follows that Apple, as a vertically integrated firm, can impose restrictions on its handset manufacturers in ways that Google cannot vis-a-vis third-party handset providers.[409]

Dr. Gentzkow's claim that cross-firm coordination solves a purported "collective action problem" does not survive scrutiny. Horizontal rivals face collective action problems everywhere. Airline *A* would like to reduce capacity, but if it does so unilaterally, Airline *B* will steal traffic. If the two airlines can coordinate, they can solve the collective action problem. Although the airlines are better off, consumers are clearly worse off. Simply solving a collective action problem does not constitute an economically valid efficiency defense. Moreover, as explained in Part II.C.3, Dr. Gentzkow fails to demonstrate that the Challenged Conduct was necessary to prevent fragmentation (the specific type of coordination problem he alleges).

III. DR. TUCKER FAILS TO UNDERMINE MY CONCLUSIONS

185. In my Merits Report, I defined the relevant product and geographic markets at issue using standard antitrust economics. Market definition turns on whether or not a hypothetical

404. Singer Merits Report ¶¶401-404.
405. Singer Merits Report Part VI.G.
406. Singer Merits Report ¶3.
407. Gentzkow Report ¶634.
408. *United States v. Microsoft Corp.*, 253 F.3d 34, 67 (D.C. Cir. 2001).
409. Nor is Google economically analogous to manufacturer simply imposing vertical restrictions on a retailer of its products in order to promote intrabrand competition. The Challenged Conduct forecloses third-party rivals who would otherwise competitively supply products in relevant antitrust product markets within the Android ecosystem.

monopolist could profitably raise prices above competitive levels if it were the only seller of a given group of substitute products.[410] Market definition turns on demand substitution—that is, consumers' willingness and ability (or lack thereof) to switch to products outside the relevant market in response to a price increase.[411] In other words, an economist draws a circle around a set of products and then evaluates the extent to which purchasers of that product would be willing and able to substitute to products outside of that circle in the event of a price increase above competitive levels.

186. I defined three relevant antitrust markets: the market for Licensable Mobile Operating Systems;[412] the Android App Distribution Market;[413] and the In-App Aftermarket.[414] I used two standard economic methods to demonstrate each of these markets constitutes a relevant antitrust market. I first used direct evidence[415] to establish that Google has already profitably held prices significantly above competitive levels in the Android App Distribution Market and the In-App Aftermarket, which means that Google has market power in these markets.[416]

187. I also used indirect evidence to propose and evaluate relevant antitrust product markets using the standard hypothetical monopolist test ("HMT").[417] The HMT requires that a relevant antitrust product market contain enough substitute products such that a hypothetical monopolist that was the only present and future seller of those products could profitably impose a small but significant and non-transitory increase in price ("SSNIP") above competitive levels.[418] If a candidate market contains too few substitute products for a hypothetical monopolist to profitably exercise a SSNIP, the relevant market is expanded by adding more substitute products

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410. Department of Justice & Federal Trade Commission, *Horizontal Merger Guidelines* (2010), §4.1.1 [hereafter, Merger Guidelines].

411. Merger Guidelines, §4. ("Market definition focuses solely on demand substitution factors, i.e., on customers' ability and willingness to substitute away from one product to another in response to a price increase or a corresponding non-price change such as a reduction in product quality or service.")

412. Singer Merits Report Part I.

413. Singer Merits Report Part II.

414. Singer Merits Report Part III.

415. Herbert Hovenkamp, *Digital Cluster Markets*, 1 COLUMBIA BUSINESS LAW REVIEW 246, 272 (2022) ("By contrast, 'direct' proof relies on estimates of firm elasticity of demand, evidenced mainly by a firm's price-cost margins or output responses to price changes.[] These methodologies are capable of giving more accurate measures of market power as it is best defined---the ability of a firm to profit by raising its price above its costs[.]") As Hovenkamp observes, "digital markets are particularly susceptible to direct measurements of market power that do not depend on a market definition." *Id.* at 246.

416. *See, e.g.,* Jonathan Baker & Timothy Bresnahan, *Economic Evidence in Antitrust: Defining Markets and Measuring Market Power in* PAOLO BUCCIROSSI, ED., HANDBOOK OF ANTITRUST ECONOMICS 1- 42 (MIT Press 2008) [hereafter Baker & Bresnahan], at 15. *See also* Aaron S. Edlin & Daniel L. Rubinfeld, *Exclusive or Efficient Pricing? The Big Deal Bundling of Academic Journals*, 72 ANTITRUST L.J. 119, 141 (2004) ("Market definition is only a traditional means to the end of determining whether power over price exists. Power over price is what matters…if power can be shown directly, there is no need for market definition: the value of market definition is in cases where power cannot be shown directly and must be inferred from sufficiently high market share in a relevant market."). *See also* PHILLIP E. AREEDA, EINER ELHAUGE & HERBERT HOVENKAMP, 10 ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION 267, 325–28, ¶ 1758b. (1996 & Supp. 2003); *see also* PHILLIP AREEDA, LOUIS KAPLOW & AARON EDLIN, ANTITRUST ANALYSIS: PROBLEMS, TEXT AND CASES ¶ 344 (6th ed. 2004). *See also* Merger Guidelines, §4 ("[e]vidence of competitive effects can inform market definition[.]").

417. Merger Guidelines, §4.1.1.

418. *Id.*

until a SSNIP becomes profitable.[419] The HMT is typically assessed using a five percent hypothetical price increase or SSNIP.[420] My market definition analysis is supported by empirical analyses to inform both the HMT and direct evidence of monopoly prices.[421] Consistent with standard practice, I also used qualitative evidence to inform my analysis.[422]

188. Dr. Tucker claims that the Play Store competes in a vast overarching megamarket, which she defines as the U.S. market for the "facilitation of digital content transactions."[423] Dr. Tucker's market definition includes all digital content transactions within the Android ecosystem,[424] as well as within the entire Apple ecosystem,[425] OEMs,[426] websites generally,[427] gaming platforms such as the Xbox, PlayStation, and Nintendo Switch, and PC platforms such as Steam and the Epic Games Store.[428]

189. If Dr. Tucker is to be believed, the Play Store has no ability to profitably increase prices above competitive levels, and it still could not do so unless Google were the sole monopolist over all the "ecosystems" that facilitate the provision of digital content, including the manufacture, sale, and payment for Android- and Apple-based mobile devices, PCs, gaming platforms, apps, and payment systems. By Dr. Tucker's logic, the Department of Justice could allow megamergers of, for example, all PC manufacturers or all OEMs, or all entities in the Android ecosystem, without risking any significant diminution in competition.[429]

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419. *Id. See also* Department of Justice & Federal Trade Commission, Horizontal Merger Guidelines, *reprinted in* 4 Trade. Reg. Rep. ¶ 13,104, at § 1.11 (1992) ("If, in response to the price increase, the reduction in sales of the product would be large enough that a hypothetical monopolist would not find it profitable to impose such an increase in price, then the Agency will add to the product group the product that is the next-best substitute for the merging firm's product…The price increase question is then asked for a hypothetical monopolist controlling the expanded product group. This process will continue until a group of products is identified such that a hypothetical monopolist over that group of products would profitably impose at least a "small but significant and nontransitory" increase ["SSNIP"], including the price of a product of one of the merging firms.") *See also* Michael L. Katz and Carl Shapiro, *Critical Loss: Let's Tell the Whole Story*, ANTITRUST 49 (2003) ("The now-standard procedure for defining relevant product markets in horizontal merger cases asks whether a hypothetical monopolist controlling a group of products would find it profitable to raise the price of at least one product significantly above the prevailing level.").

420. Merger Guidelines §4.1.2 ("The Agencies most often use a SSNIP of five percent of the price paid by customers for the products or services to which the merging firms contribute value. However, what constitutes a 'small but significant' increase in price, commensurate with a significant loss of competition caused by the merger, depends upon the nature of the industry and the merging firms' positions in it, and the Agencies may accordingly use a price increase that is larger or smaller than five percent.").

421. Singer Merits Report ¶¶74-78

422. Singer Merits Report ¶¶79-85.

423. Tucker Report ¶¶94-98.

424. Dr. Tucker also alleges that apps can be sideloaded, pre-installed, or be downloaded through other Android App stores. This is subsumed within my Android App Distribution Market definition. *See* Singer Merits Report Part II.A.

425. Tucker Report ¶153.

426. Tucker Report ¶20

427. Tucker Report ¶218.

428. Tucker Report ¶276.

429. Dr. Tucker claims that Google's recent take rate reductions are evidence of "direct price competition between the Google Play store and the Apple App Store" and is "not consistent with Google acquiring or maintaining monopoly power in the relevant market defined by Plaintiffs' expert reports." Tucker Report ¶¶462-466. Dr. Tucker

190. As detailed below, Dr. Tucker's proposed megamarket of all digital content facilitation is fatally flawed and is divorced from standard antitrust economics.

191. Dr. Tucker ignores the elementary principle that antitrust product markets are defined using substitute products, not complementary products. For example, a Samsung device is obviously not a substitute for the Google Android mobile OS because consumers cannot respond to an increase in the price of one by substituting to the other. Yet Dr. Tucker lumps into her proposed relevant market complementary products that cannot be substitutes. Dr. Tucker also ignores the elementary antitrust principle that product markets are defined based on the smallest (not the largest) set of substitutes that a hypothetical monopolist would need to control to exercise market power.

192. Dr. Tucker does not perform an HMT or any other standard antitrust analysis to support her market definition. Dr. Tucker's calculation of the Play Store's [redacted] to [redacted] percent share of "consumer spending on digital transactions"[430] does not reflect the Play Store's share of a coherently defined relevant antitrust market. Dr. Tucker's analysis also suffers from the Cellophane fallacy, according to which markets may be defined too broadly if the economist fails to take into account that current prices are already above competitive levels, leading customers to substitute towards products that would not be considered economic substitutes if prices were at competitive levels.[431]

193. In Part III.A below, I explain the flaws in Dr. Tucker's proposed market definition. I then explain in Parts III.B-III.C why Dr. Tucker's specific critiques of my market definitions and my conclusions regarding Google's monopoly power in these relevant markets are without merit and do not undermine my conclusions.

A. Dr. Tucker's Proposed Megamarket Disregards Elementary Principles of Antitrust Economics

1. A Relevant Antitrust Market Is Comprised of Substitutes, Not Complements

194. Dr. Tucker's market for the "facilitation of digital content transactions" fails the most basic requirements of a relevant antitrust market. The *Horizontal Merger Guidelines* clearly state that a properly defined antitrust market consists of products that a consumer would substitute in response to a price increase.[432] Dr. Tucker recognizes this principle in the opening discussion of her report:

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does not consider the possibility that Google's recent take rate reductions could have been implemented in a bid to ward off potential litigation or regulation. *See, e.g.,* Rep. Buck Introduces the State Antitrust Enforcement Venue Act (May 21, 2021), *available at* https://buck.house.gov/media-center/press-releases/rep-buck-introduces-state-antitrust-enforcement-venue-act ; Klobuchar, Lee Bill to Empower State Antitrust Enforcers Passes Judiciary Committee (September 23, 2021), *available at* https://www.klobuchar.senate.gov/public/index.cfm/news-releases?ID=FB43A176-4E1C-4B7E-944D-152FB01ED92F.

430. Tucker Report ¶63; ¶520.

431. Luke Froeb & Gregory Werden, *The Reverse Cellophane Fallacy in Market Delineation*, 7 REVIEW OF INDUSTRIAL ORGANIZATION 241-247, 241 (1992).

432. Merger Guidelines, §4.

> A relevant antitrust market must reflect the effective area of competition for the focal product or service, based on an analysis of the alternatives that are substitutable. These substitutes constrain the focal firm's ability to change price, quality or output in a way that benefits the firm and not consumers. For an economist, the set of competing products that define a relevant antitrust product market is the set of products that consumers would switch to if prices increase or quality is reduced relative to the price or quality that would prevail absent monopoly power.[433]

195. Two paragraphs later, Dr. Tucker claims that "the product in this case is the facilitation of digital content transactions—paid and unpaid—between users and developers."[434] Dr. Tucker includes the entire Android and Apple ecosystems in her market definition; for example, all of Dr. Tucker's evidence in Part VI.A.1 of her report relate to the competition of Apple and Android phones, not the app stores. But the Android ecosystem (as well as the Apple ecosystem) contains many complementary products. Google Android, the operating system, is a complement to a smartphone. Apps and App Stores are complements to Google Android. Apps and App stores are also complementary to smartphones, and so on. Dr. Tucker's proposed market definition therefore fails from the outset.

196. Dr. Tucker claims that "[t]he concept of an 'ecosystem' makes clear that all parts of the system are related and must be considered together when analyzing competitive constraints."[435] Dr. Tucker is wrong; she cites no authority or literature that supports this claim. Antitrust practitioners explicitly disavow including an entire "ecosystem" (or "commercial reality" justifications) in a relevant market. As explained by Professor Areeda in his antitrust treatise:

> Grouping complementary goods into the same market is not only economic nonsense, it also undermines the rationale for the policy against monopolization or collusion in the first place. [M]any "commercial realities" describe a particular market situation, and their invocation should not become an after-the-fact rationalization for a conclusion that is completely inconsistent with the economic rationale for defining markets.[436]

The most charitable interpretation of Dr. Tucker's position is that Google has no incentive or ability to exercise power in one part of the ecosystem lest it negatively impact the whole ecosystem and thus its competitive position vis-à-vis Apple. But this is not an expression of the relevant antitrust product market, which is the *smallest* collection of *substitutes* such that a hypothetical monopolist could exercise market power. It is instead Dr. Tucker's speculation regarding some

433. Tucker Report ¶7.
434. Tucker Report ¶9.
435. Tucker Report ¶14.
436. Areda and Hovenkamp, *Cluster Markets and Two-Sided Platforms: Distinguishing Substitutes from Complements* in ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION (2022). *Id* ¶565 ("As economists have long understood, a relevant market consists only of goods that are reasonably close substitutes for one another. The Supreme Court has indicated that relevant markets are composed of substitutes by defining market boundaries in terms of cross-elasticity of demand. That term speaks of the rate at which people will substitute one item in response to a price increase in a different item—a comparison that applies only to a relationship of substitution.").

unrelated competitive constraint that purportedly operates at a different layer of the ecosystem. And if such a constraint exists, it has done nothing to prevent Google from imposing supra-competitive take rates on the Play Store.

197. Dr. Tucker claims incorrectly that I agree that "Android device users' ability to choose iPhones and iPads competitively constrains Google in operating and pricing the Google Play store" because I relied on a Google document that references the Play Store's contribution to "creating brand loyalty and 'stickiness' to Android and the Google ecosystem."[437] Dr. Tucker wrongly conflates the limited competition between the Android and iOS operating systems at the time of a user's initial device purchase with competition between the Play Store and Apple's App Store once a user is locked into owning a device in one of those ecosystems. The Play Store may contribute to some OS-level stickiness by causing users to remain with Android at the time of their next device purchase, but that does not mean (as Dr. Tucker suggests) that the Play Store is competitively constrained in its pricing by that limited competition at the time of the initial device purchase. In fact, the document I cite supports my conclusion that there are substantial switching costs between Apple and Android devices, which contributes to the Play Store's market power, as the Apple App Store obviously is not available on Android devices.[438] These switching costs reinforce Google's monopoly power. Put differently, after the initial purchase of an Android phone, the customers are locked in, and they also have no real insight into lifecycle pricing for apps. Thus, any competition in that market does not constrain Google's market power in the Android App Distribution Market.

2. A Relevant Antitrust Market Should Contain the Smallest Set of Substitutes Necessary To Exercise Market Power

198. Dr. Tucker ignores the elementary principle that antitrust product markets are defined based on the *smallest* set of substitutes that a hypothetical monopolist would need to control to exercise market power.[439] The *Horizontal Merger Guidelines* give the following example for why defining a market too broadly might lead to misleading results:

> Firms A and B, sellers of two leading brands of motorcycles, propose to merge. If Brand A motorcycle prices were to rise, some buyers would substitute to Brand B, and some others would substitute to cars. However, motorcycle buyers see Brand B motorcycles as much more similar to Brand A motorcycles than are cars. Far more cars are sold than motorcycles. Evaluating shares in a market that includes cars would greatly underestimate the competitive significance of Brand B

437. Tucker Report ¶183, ¶184(d).

438. Singer Merits Report ¶52.

439. Merger Guidelines §4.1.1 ("Because the relative competitive significance of more distant substitutes is apt to be overstated by their share of sales, when the Agencies rely on market shares and concentration, they usually do so in the smallest relevant market satisfying the hypothetical monopolist test."). *Id.* §4 ("Defining a market broadly to include relatively distant product or geographic substitutes can lead to misleading market shares. This is because the competitive significance of distant substitutes is unlikely to be commensurate with their shares in a broad market. Although excluding more distant substitutes from the market inevitably understates their competitive significance to some degree, doing so often provides a more accurate indicator of the competitive effects of the merger than would the alternative of including them and overstating their competitive significance as proportional to their shares in an expanded market.")

motorcycles in constraining Brand A's prices and greatly overestimate the significance of cars.[440]

199. In her proposed market, Dr. Tucker includes products which "facilitate digital content transactions" such as websites and game consoles.[441] These do not belong in the relevant market because a hypothetical monopolist of App distribution on Android phones would not need to control them in order to exercise monopoly power.[442] If Google increased the price of the Play Store by some SSNIP, say by raising the take rate, developers (and their customers) would not move to websites and game consoles. Ultimately, whether or not consumers are willing and able to switch to an alternative product is an empirical question which is answered by the HMT, which I have performed for both the Android App Distribution Market and the In-App Aftermarket.[443]

3. The Relevant Antitrust Market Is Defined Solely Based on Demand-Side Substitution

200. Dr. Tucker's market definition fails to incorporate the elementary antitrust principle that antitrust product markets are defined solely based on demand-side substitution—the demand response of developers or users—as opposed to the supply-side decisions of platform owners such as Google. As the *Merger Guidelines* explain:

> Market definition focuses solely on demand substitution factors, i.e., on customers' ability and willingness to substitute away from one product to another in response to a price increase or a corresponding non-price change such as a reduction in product quality or service.[444]

Dr. Tucker acknowledges this principle in her report[445] but discards it in her market definition analysis. When defining the relevant market as the "facilitation of digital content transactions," Dr. Tucker does not focus solely on demand substitution factors. Much of the focus in Dr. Tucker's market definition analysis is driven by (her view of) Google's (the supplier) views of the market.[446] The most charitable interpretation of her argument is that, when defining markets with a two-sided platform, one should consider both sides of the platform. I did so in my SSNIP tests for the Android App Distribution Market.[447]

4. Dr. Tucker's Proposed Megamarket Suffers from the Cellophane Fallacy

201. Dr. Tucker's market definition analysis suffers from the Cellophane fallacy in that she fails to recognize that Google's take rate in the actual world reflects the exercise of significant

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440. Merger Guidelines §4.
441. Tucker Report ¶218, ¶276.
442. Singer Merits Report ¶101; ¶¶103-104.
443. Singer Merits Report Parts II.A.1 and III.A.3.
444. Merger Guidelines, §4.
445. Tucker Report ¶86.
446. *See, e.g.,* Tucker Report Part III.B.1 ("The Relevant Product is the Facilitation of Digital Content Transactions"), ¶¶94-98.
447. Singer Merits Report Part II.A.1.

monopoly power.[448] Although Dr. Tucker mentions the Cellophane fallacy briefly in her report, her analysis proceeds without any further consideration of it.[449] In my Merits Report, I was careful to construct my HMT to avoid the Cellophane fallacy by imposing the SSNIP at the estimated competitive take rate, rather than the actual world take rate, which is a supracompetitive price.[450] If a market is already monopolized by an entity, more distant substitute products may appear to be closer substitutes than they would be in a competitive world. Because Google's take rate is far above the competitive take rate, as confirmed by my models and competitive benchmarks, we already know via direct evidence that Google has market power. That distant substitutes such as Apple's App Store might appear to be closer substitutes at Google's supra-competitive take rate is irrelevant.

B. Dr. Tucker's Critiques of My Market Definitions Are Without Merit

202. In addition to her incorrect claim that Google competes in a single market for the facilitation of digital market transactions, Dr. Tucker offers some specific criticisms of how I define the three relevant antitrust markets in my Merits Report. As explained below, Dr. Tucker's criticisms do not undermine my conclusions.

203. It bears emphasis that although Dr. Tucker claims that my relevant markets are "arbitrarily defined" and "define away" the competition, Dr. Tucker does not dispute that I used standard antitrust market definition methods, such as the SSNIP and the HMT, to inform my market definition analysis.[451]

1. The Market For Licensable Mobile Operating Systems Is A Relevant Antitrust Product Market

204. Dr. Tucker claims incorrectly that I "Misstate the Role of the Operating System in the Android Ecosystem."[452] According to Dr. Tucker, "By building the Android ecosystem and providing handset manufacturers with a high-quality operating system that is freely available, Google has enabled handset manufacturers as part of that mobile ecosystem to effectively compete with the Apple's tightly interconnected ecosystem…."[453] In other words, Dr. Tucker recognizes the elementary economic fact that Google Android and smartphones are complements, as opposed to substitutes. It follows that I was correct to exclude OEMs from the relevant market for licensable mobile OSs, and that Dr. Tucker was incorrect to lump them together in her proposed megamarket.

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448. *United States v. E. I. du Pont de Nemours & Co.*, 351 U.S. 377 (1956). *See also* Luke Froeb & Gregory Werden, *The Reverse Cellophane Fallacy in Market Delineation*, 7 REVIEW OF INDUSTRIAL ORGANIZATION 241-247, 241 (1992) ("In the landmark Cellophane case, the Supreme Court erroneously concluded that du Pont did not have significant market power because the Court evaluated the elasticity of demand for Cellophane at the monopoly equilibrium, at which the elasticity was far higher than at the competitive equilibrium."); *see also* Landes & Posner, *supra*, at 960-961.

449. Tucker Report ¶85.

450. Singer Merits Report ¶92.

451. Tucker Report ¶320 ("Separating Google's Android ecosystem into three arbitrarily defined discrete markets means that Plaintiffs' expert reports define away the Android ecosystem's competition with Apple and other alternatives that competitively constrain Android and the Google Play store.")

452. Tucker Report ¶¶322-326.

453. Tucker Report ¶323.

205. According to Dr. Tucker, "[c]laims that users do not switch across ecosystems after making their initial purchase decision are inconsistent with survey evidence."[454] This misrepresents my opinion—I do not claim that switching across ecosystems never occurs; what I demonstrate is that there are substantial barriers to switching.[455] As Dr. Tucker concedes, Google's own documents, including studies between 2016 and 2019, provide evidence of switching costs.[456] Dr. Tucker attempts to dismiss this evidence by suggesting that "learning costs from switching to Android or Apple have declined over time as the two operating systems have become more similar and have similar features."[457] Put differently, Dr. Tucker concedes there is evidence of switching costs during the Class Period.[458] Finally, Dr. Tucker attempts to dismiss the evidence of switching costs by pointing out that rates of switching between iOS and Android are comparable to (though generally lower than) estimated rates of switching between brands of other consumer products, such as ketchup.[459] This argument is specious. The relatively low switching rate for these consumer products might be explained by other factors, such as consumer inertia; meanwhile, I have provided evidence that the low rates of switching between iOS and Android are the product of switching costs faced by consumers.[460]

206. As Dr. Tucker acknowledges, users with multiple devices are more likely to own devices within the same ecosystem; for example, an Apple iPhone owner may also own an iPad, a MacBook, and so on.[461] Dr. Tucker perversely interprets this as evidence against a separate market for licensable mobile operating systems; according to Dr. Tucker, if "iOS users are satisfied with Apple products and the Apple ecosystem," this "would create a large incentive for Google to make the Android ecosystem competitive with the Apple ecosystem…."[462] This misses the point entirely. The evidence shows that the two ecosystems are differentiated and that switching between them is costly.

207. Based on Figures 10.A-B of her report, Dr Tucker claims that Android's share of U.S. sales has been declining relative to iOS, but this ignores more recent data, as shown below. The data also illustrate Android's virtual monopoly on licensable mobile OSs.

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454. Tucker Report ¶331.

455. Singer Merits Report ¶¶46-55. Dr. Tucker cites an estimate for the switching rate among Tropicana orange juice, and asserts this shows evidence of comparable switching rates in a market "without any evidence of monopoly power." Tucker Report ¶332. In fact, there is evidence of substantial upstream concentration in this market. *See* Peter Chung, "How Brazil stole the production of orange juice from Florida," *CNBC* (August 23, 2018), ("Today, more than 50 percent of all orange juice bottled by major companies like Tropicana is supplied by a Brazilian company[.]"). Moreover, Tropicana is the market leader, accounting for about one third of the US refrigerated orange juice market. *See* https://www.statista.com/statistics/660680/market-share-top-refrigerated-orange-juice-brands-united-states/. Moreover, the published version of the article cited by Dr. Tucker for her Tropicana switching cost estimate explains that "consumers exhibit inertia in their brand choices, a form of psychological switching cost;" the authors of the study selected this market precisely because of the presence of non-trivial switching costs. Jean-Pierre Dubé et. al., *Do Switching Costs Make Markets Less Competitive*? 46(4) JOURNAL OF MARKETING RESEARCH (2009), at Abstract.

456. Tucker Report ¶335.

457. *Id.*

458. *See also* Tucker Report ¶337 (conceding that, according to a 2017 study, Google "was worried about switching costs from Apple devices[.]").

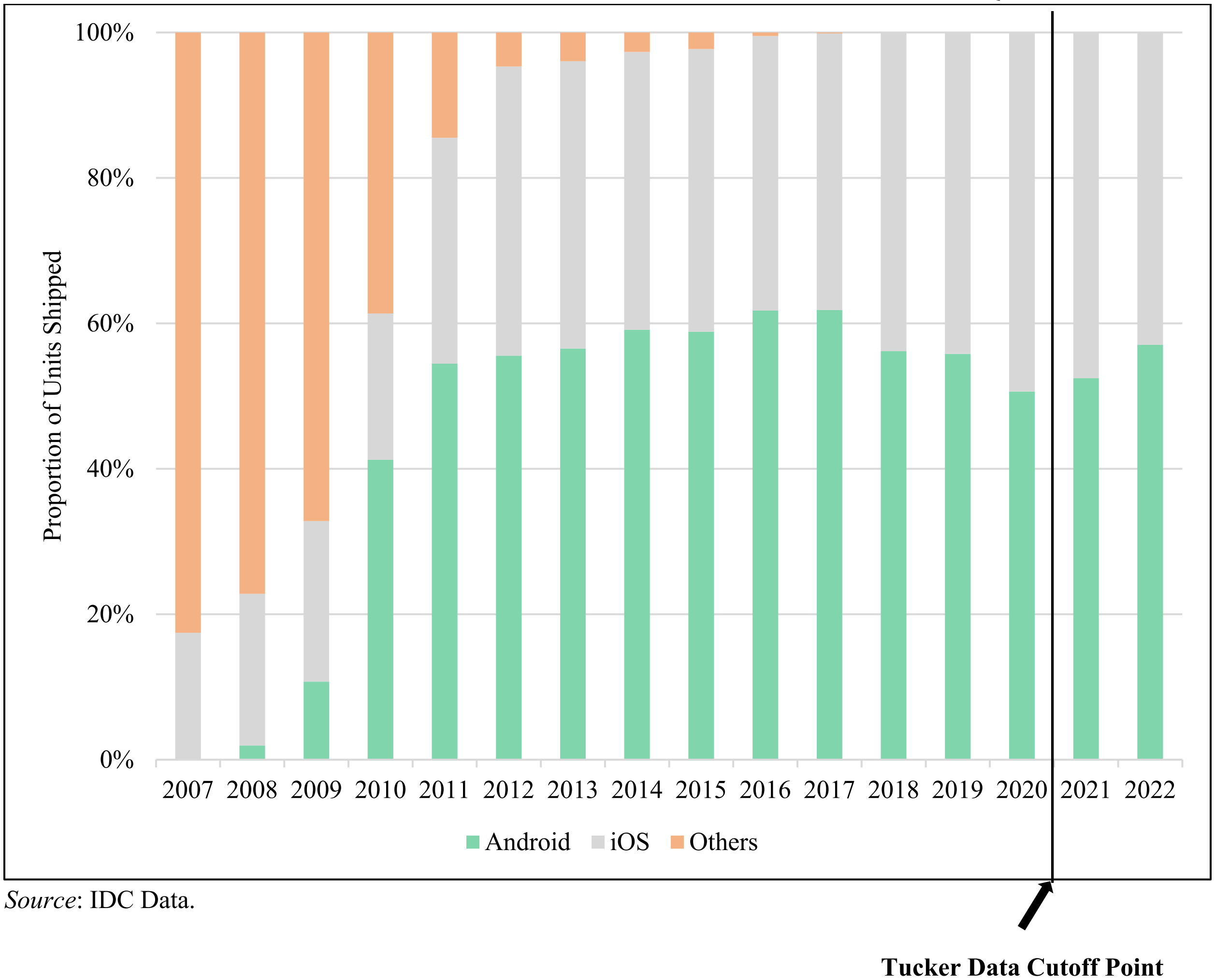
459. Tucker Report ¶173.

460. *See* Singer Merits Report ¶¶48-54.

461. Tucker Report ¶344.

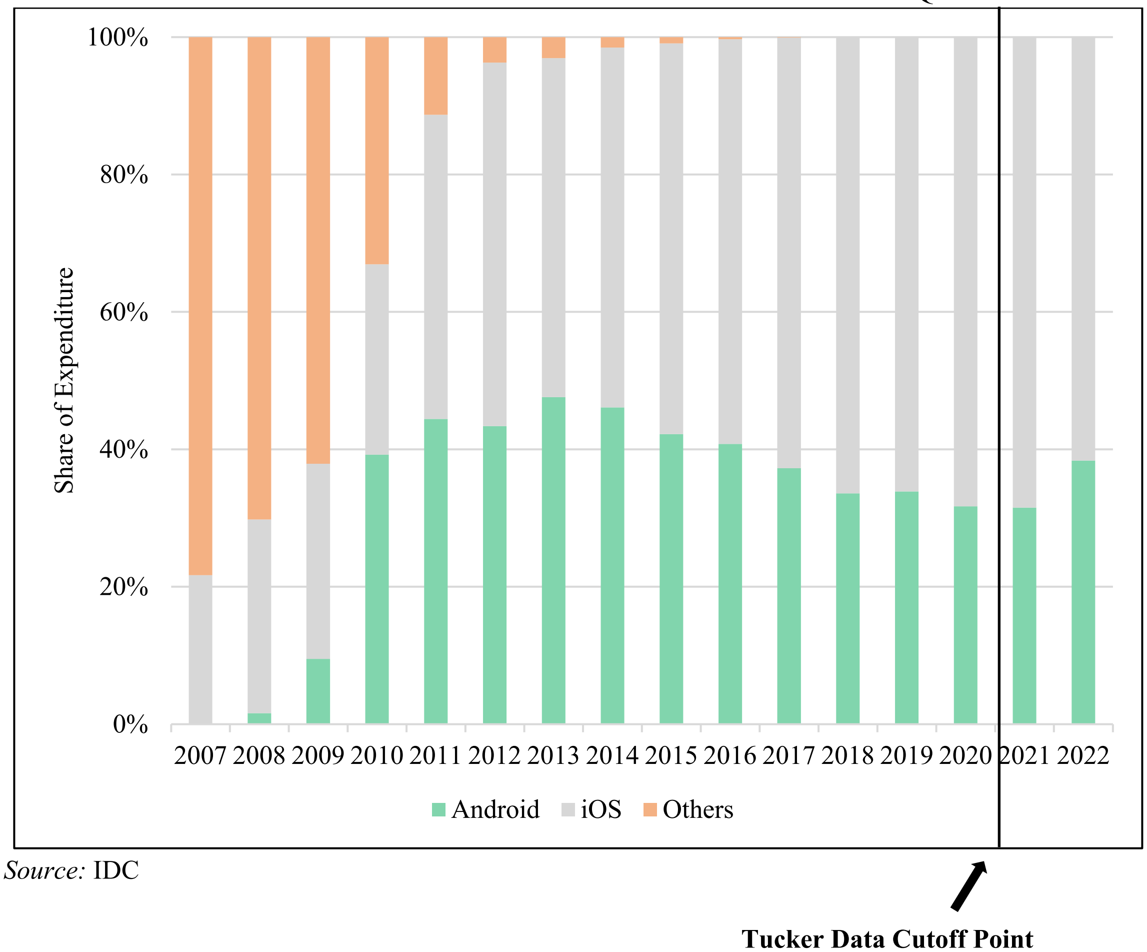
462. *Id.*

FIGURE 13: DR. TUCKER'S FIGURE 10.A, UPDATED THROUGH Q2 2022



Source: IDC Data.

FIGURE 14: DR. TUCKER'S FIGURE 10.B UPDATED THROUGH Q2 2022



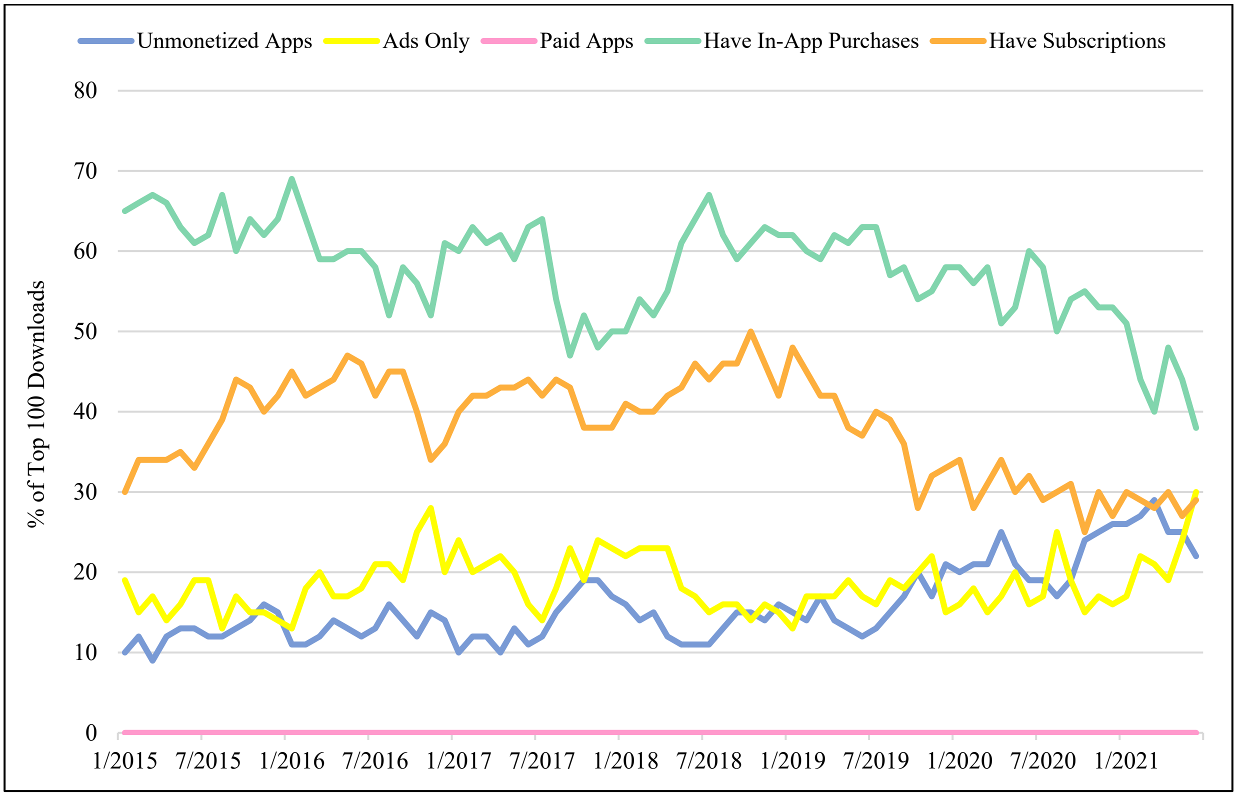
Source: IDC

208. Dr. Tucker claims incorrectly that I "overstate the monetary barriers" to switching between ecosystems because "the vast majority (99.9% in 2020) of Android applications downloaded from the Google Play store were free," because "[o]nly about [redacted]% of all U.S. Android smartphone users made a paid download from the Google Play store in 2020," and because "most Android users do not make any purchases from the Google Play store."[463] But none of this evidence suggests that it is not costly (in time, money, and effort) to switch from one ecosystem to another. In addition, that the vast majority of Android users do not use or spend money in the Play Store is inconsistent with Dr. Tucker's emphasis on the Play Store as a critical driver of ecosystem competition.

209. Based on Figure 5 of her report, Dr. Tucker claims that most Google Android Apps are monetized through advertising (or not at all). As illustrated below, monetization outside of advertising is significantly more common among the most frequently downloaded Apps.

463. Tucker Report ¶¶ 345-347.

FIGURE 15: MONETIZATION STRATEGY OF TOP 100 DOWNLOADED APPS
JANUARY 2015—MAY 2021



Sources: Tucker backup; Gentzkow backup; App Annie data (download amounts); App Catalog Data (monetization strategy). Top 100 downloaded apps defined as the 100 App Annie apps with the highest download counts per month that were capable of merging into the App Catalog Data. 99.4% of App Annie top 100 Play Store download monthly totals had a corresponding app package name within the App Catalog Data. Shares may not sum to 100% because apps can employ multiple monetization strategies. Monetization types are determined by the "has_ads", "is_paid", "has_iap", and "has_subs" variables in the App Catalog Data. These variables reflect an app's latest listed monetization strategy updated through May 2021 and may not reflect app monetization at the time of the release.

210. Dr. Tucker highlights evidence of "a relatively lower switching rate from the Apple ecosystem to the Android ecosystem, compared to switching rates from the Android ecosystem to the Apple ecosystem"[464] as if it were evidence against a separate market for licensable mobile operating systems. It is not, as there is no requirement that the relative switching rates must be equal (or at any predetermined ratio) for the two markets to be distinct.

211. As Dr. Tucker concedes, my Merits Report cited evidence of substantial differentiation between Google Android devices and Apple devices with respect to both pricing and features.[465] Dr. Tucker claims incorrectly that I ignore that "marginal customers can switch to Apple devices."[466] Again, I do not claim that switching across ecosystems never occurs; what I demonstrate is that there are substantial barriers to switching, which is one of the factors helping

464. Tucker Report ¶¶348-351.
465. Tucker Report ¶352.
466. *Id.*

to insulate the iOS and Google Android mobile OSs from head-to-head competition.[467] In any event, whatever switching or competition that may occur at the level of the device does not carry forward onto the Android App Distribution Market; once the customer has selected an Android-based device, switching to Apple's App Store in response to a SSNIP is no longer a practical option.

212. I explained in my Merits Report that the immense costs and complexities of developing a new mobile OS create barriers to entry, such that a SSNIP by a hypothetical monopolist of licensed operating systems would not plausibly induce an OEM to create its own system or a rival mobile OS developer to enter, and I provided evidence of these entry barriers.[468] Dr. Tucker agrees that "an operating system is indeed expensive and difficult to build."[469] Dr. Tucker claims I do not employ a "formal SSNIP test" in the market for licensable mobile operating systems,[470] but she ignores that it is standard practice to apply the conceptual framework of the HMT as I have done here.[471]

2. The Android App Distribution Market Is Separate From the In-App Aftermarket

213. Dr. Tucker claims incorrectly that the Android App Distribution Market is not separate from the In-App Aftermarket because "defining a market limited to app distribution results in a market that consists almost entirely of free products."[472] I have explained in my Merits Report why Google finds it profitable to distribute free Apps and why it would continue to do so in the but-for world.[473] Dr. Tucker also overlooks the fact that it is not uncommon for software markets to comprise a large number of free transactions and for revenue to be earned from a smaller number of paid transactions.[474] Dr. Tucker further argues that because 97 percent of Apps are free, Google is entitled to monetize the provision of matchmaking by charging for In-App Aftermarket services, meaning that they are in the same market.[475] Google is only entitled to compete for

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467. Singer Merits Report ¶¶46-57. In Table 8 of her report (¶359), Dr. Tucker claims to show switching between the Android and iOS at various price points. However, these data show that switching from Android to iOS is about [redacted] for owners of higher-priced devices (over $800) than for owners of lower-priced devices (between $200-$400). Conversely, the data also show that switching from iOS to Android is about [redacted] for lower-priced devices than higher-priced devices. This provides further confirmation that each ecosystem is focused on different consumers at different price points.

468. Singer Merits Report ¶59. For example, Microsoft was estimated to have spent more than $1 billion in developing and launching the Windows Phone, which has failed to make significant inroads into the licensable mobile OS market. *Id.*

469. Tucker Report ¶372.

470. Tucker Report Section VI.B.7 (header).

471. Merger Guidelines §4.1.3. ("Even when the evidence necessary to perform the hypothetical monopolist test quantitatively is not available, the conceptual framework of the test provides a useful methodological tool for gathering and analyzing evidence pertinent to customer substitution and to market definition.")

472. Tucker Report ¶375.

473. Singer Merits Report ¶¶401-404.

474. *See* Guadalupe Gonzalez, "Slack Makes 40 Percent of Its Revenue From Less than 1 Percent of Its Customers. Here's Why That Is Not as Bad as It Sounds," Inc. (April 29, 2019), *available at* https://www.inc.com/guadalupe-gonzalez/slack-s1-business-model.html (noting that workplace messaging company Slack earns 40% of its revenue from "less than 0.1 percent of [its] total customer base" and that in 2018 videoconferencing software Zoom earned 30% of its more than $300 million in revenue from 344 accounts).

475. Tucker Report ¶ 37, 133, 149-51, 375, 378, 381, 413(b).

business in the aftermarket; it is not entitled to capture that aftermarket exclusively and command a supra-competitive take rate. In the but-for world, Google would secure a majority of the In-App Aftermarket and it would command a price premium relative to its rivals. Accordingly, there is no reason a relevant market must be made up entirely or primarily of paid transactions, nor does Dr. Tucker provide one. Dr. Tucker's criticism thus fails to undermine my conclusion that a (not so) hypothetical monopolist that controlled the Android App Distribution Market could profitably exercise market power.

214. Dr. Tucker claims incorrectly that the In-App Aftermarket is defined too narrowly because:

> [U]sers can use apps such as Candy Crush Saga, Tinder, and Pandora for free today, but can easily substitute to making in-app purchases or purchase a subscription version in the future. By the same logic, users who make payments in these apps today can easily stop making in-app purchases or cancel the subscription if prices were to rise in the future.[476]

This reasoning is incorrect. The fact that users can still benefit from a primary market if they abandon an aftermarket product due to a price increase does not mean that the aftermarket is part of the primary market. By Dr. Tucker's logic, there is no separate market for carwashes because car owners who currently choose to wash their car could instead opt to drive dirty cars if the price of carwashes went up.

215. Dr. Tucker claims incorrectly that the Android App Distribution Market is not separate from the In-App Aftermarket. According to Dr. Tucker, defining separate markets "does not make sense because the relationship between the two is important to Google's competitive strategy for the Google Play store."[477] This ignores standard antitrust economics that market definition is based solely on demand-side substitution, not on the "competitive strategy" of the supplier.

216. Dr. Tucker claims incorrectly that the Android App Distribution Market is not separate from the In-App Aftermarket because I cited industry data that aggregates revenues across the two markets.[478] That an industry analyst reported data in a certain way does not inform market definition and is in no way inconsistent with my conclusions. By this logic, an industry report with a table displaying aggregate U.S. auto sales would fatally undermine an economist's conclusion that a $250,000 Tesla and a $25,000 Ford EcoSport are not in the same relevant market.

217. Dr. Tucker quotes lines from my report out of context to support her argument that the Android App Distribution and In-App Aftermarket are not distinct. Dr. Tucker writes, "The Singer Report is not correct that the 'Play Store is not needed' after an initial download."[479] Dr. Tucker omits the end of this sentence, in which I wrote that the "Play Store is not needed *in these*

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476. Tucker Report ¶376.
477. Tucker Report ¶377.
478. Tucker Report ¶379.
479. Tucker Report ¶ 382.

In-App Aftermarket services, as the matchmaking function is not present."[480] This discussion in my report was aimed at distinguishing the two-sided Android App Distribution Market, in which Google provides services to developers such as matchmaking, with the one-sided In-App Aftermarket, as the quoted section of my report explained, in which Google provides no similar valuable service for developers that they could not obtain elsewhere. Dr. Tucker nowhere establishes that the tasks she describes, such as updates for previously downloaded apps, are not properly considered to be part of just one of these two separate markets.[481]

3. The Android App Distribution Market Is A Relevant Antitrust Product Market

218. In my Merits Report, I explained that, from a developer's perspective, iOS and Android do not compete as "either-or" substitutes; a developer that restricted itself only to iOS would deprive itself of the revenue to be gained from accessing Android's massive installed customer base (and vice-versa).[482] Dr. Tucker disputes this conclusion because, she claims, it "characterizes competition for developers as binary."[483] Dr. Tucker does not explain how or why looking at competition in discrete versus continuous terms would alter the fact that developers rationally seek to maximize their reach across both platforms. Dr. Tucker provides no evidence that a SSNIP in the Android App Distribution Market would be unprofitable because it would be defeated by developers choosing to remove their Apps from the Android ecosystem and to offer their Apps only on iOS.

219. Dr. Tucker's claim that "users multihome to access app content across different platforms, which reduces users' switching costs and gives developers options to monetize their content on these platforms"[484] does not upset my market definition. If anything, that users multihome within the same game across different platforms indicates that the platforms are complements from the perspective of the user, which would be expected to reinforce platform complementarity from the developer's perspective as well.

220. Dr. Tucker fails to acknowledge significant differences in gaming on mobile devices compared with other platforms. Developers approach mobile and PC gaming differently, reflecting system limitations and user expectations. For example, "mobile devices have limited storage space and processing power compared to gaming computers, so [developers] need to be mindful of these limitations[.]"[485] Additionally, users "expect shorter gameplay sessions on their phones or tablets, and they're less likely to have the patience for complex games with a lot of rules."[486]

221. Dr. Tucker focuses on recent innovations that might possibly serve to make mobile and PC gaming more substitutable in the future, but they have not been sufficiently developed or

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480. Singer Merits Report ¶ 143 (emphasis added).
481. Tucker ¶382.
482. Singer Merits Report ¶¶56-57.
483. Tucker Report ¶385.
484. Tucker Report ¶387.
485. Abhinay, *Difference Between Mobile and PC Game Development,* Juego Studio, September 5, 2022, *available at* https://www.juegostudio.com/blog/difference-between-mobile-and-pc-game-development.
486. *Id.*

deployed to have this effect during the Class Period. These new technologies include the Steam Deck and cloud gaming.[487] As Dr. Tucker concedes, Steam Deck was not launched until February 2022.[488] Dr. Tucker provides no analysis of any competitive effects of Steam Deck in the relevant markets at issue.[489] Similarly, cloud gaming is a recent technology. According to Dr. Tucker's Table 7, no cloud gaming system was available before November 2019, with most first appearing in 2020.[490] Dr. Tucker relies on revenue projections for 2024, as well as conjecture regarding the "potential" of the technology.[491] Industry reviews suggest that cloud gaming was still "in a transitional period" as of May 2022, and that "[c]loud gaming just isn't viable yet for many of the high-demand, high-speed AAA titles on the market[.]"[492] It has also been described as a "niche market" that is "unlikely to replace on-device gaming any time soon."[493]

222. Dr. Tucker's claim that web-based apps should be included in the relevant market is unpersuasive.[494] My Merits Report provided evidence (including but not limited to Google documents) showing that web-based apps have more limited functionality than native apps, including an inability to access the device camera or operate offline, and therefore cannot serve as a substitute for native Android apps.[495] Dr. Tucker does not engage with this evidence. Dr. Tucker provides no evidence that a SSNIP in the Android App Distribution Market would be unprofitable because it would be defeated by developers choosing to remove their Apps from the Play Store and offer only web-based Apps. In addition, the Challenged Conduct includes anti-steering provisions, further dampening the competitive significance of web-based Apps.[496]

223. In Figure 23 of her report, Dr. Tucker provides evidence that web-based Apps are not in the relevant market. In this figure, Dr. Tucker is trying to demonstrate that the native Tinder app and Tinder's "Progressive Web App" (PWA) have a similar appearance.[497] The screen capture of the billing screens shows that the web-based version of Tinder is priced at $22.49, and the Play Store price is $24.99, or 11.1 percent higher. That consumers are willing to pay a significant premium for the same App when distributed through the Play Store provides additional evidence

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487. Tucker Report §V.C.3.
488. Tucker Report ¶306.
489. *Id.*
490. Tucker Report Table 7.
491. Tucker Report ¶308 ; ¶310.
492. Kingston Technology, *What are the advantages and disadvantages of Cloud gaming?,* May 2022, *available at* https://www.kingston.com/en/blog/gaming/cloud-gaming-advantages-disadvantages.
493. Rupantar Guha, *What is cloud gaming and why does it matter?,* Verdict, October 21, 2022, *available at* https://www.verdict.co.uk/what-is-cloud-gaming-and-why-does-it-matter/.
494. Tucker Report ¶¶388-391.
495. Singer Merits Report ¶104.
496. Singer Merits Report ¶30.
497. Tucker Report ¶238. ("Web apps also should be included in the relevant market. Web apps represent technological improvements on the mobile apps. Unlike native apps, which are developed specifically for one platform and usually installed from an app store, web apps are accessed through a web browser. Gmail, Slack, Facebook, Tinder and Twitter are examples of apps that exist in both native and web app versions.")

that web-based Apps are not in the relevant market.[498] Moreover, the premium (11.1 percent) is above the usual five percent SSNIP used to define relevant markets.

224. In my Merits Report, I performed one-sided and two-sided SSNIP tests demonstrating that the Android App Distribution Market is a relevant antitrust product market.[499] Dr. Tucker claims incorrectly that my HMT is flawed because it "assumes Google's pricing should be close to marginal cost."[500] Relatedly, Dr. Tucker claims my HMT "ignores the fixed and investment costs in developing and operating an operating system and the Google Play store."[501] In fact, I allow for Google to charge a take rate substantially above marginal cost, even in a more competitive but-for world. In the Android App Distribution Market, Google is estimated to earn a price-cost margin of [redacted] percent in the but-for world,[502] inclusive of the Play Store's direct costs of sales and direct operating expenses.[503] Because my models allow for Google to charge substantial markup in the but-for world, Google would remain profitable even after accounting for early losses and fixed investment costs.[504] Dr. Tucker claims that Google's financials are "not indicative of Google's actual costs to sell an app,"[505] but fails to explain why or how Google's P&L data is not an accurate reflection of its costs, or to identify any errors in my calculations.[506]

225. Dr. Tucker also claims that my SSNIP test is flawed because it assumes that "Google's pricing decisions in the alleged Android app distribution market are independent and distinct from its operations outside of this alleged market."[507] This is not a flaw; the SSNIP test is conducted using a hypothetical monopolist in the Android App Distribution Market. Google's operations outside of the relevant market are irrelevant for purposes of conducting the SSNIP test.

226. Dr. Tucker critiques my (conservative) assumption that Google would retain a market share of 60 percent in the but-for world.[508] I have responded to this critique in Part I.B above.[509]

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498. The two other Tinder Gold subscription options also far exceed the 5% price increase benchmark. The 12-month option has a percentage increase of 11.1% [equal to ($8.33 - $7.50)/$7.50]. The 6-month option has a percentage increase of 11% [equal to ($12.49 - $11.25)/$11.25]. Additionally, my Merits report shows that Tinder's other products, Tinder Plus and Tinder Platinum, both have prices approximately 10% higher when purchased through the Play Store instead of the web app. *See* Singer Merits Report ¶365 n.858.

499. Singer Merits Report ¶¶92-99.

500. Tucker Report ¶¶400-401.

501. Tucker Report Appendix I, at I.9 - I.10, ¶16.

502. Equal to [redacted]. *See* Singer Merits Report Table 6, rows [15] and [16].

503. Singer Merits Report ¶304, n. 683.

504. Mr. Chase's calculations further confirm that the Play Store would remain profitable in the but-for world.

505. Tucker Report ¶404(a).

506. Dr. Tucker asserts that my calculation of the Play Store's marginal cost akin to average costs and not indicative of the costs of an additional unit of output. *See* Tucker Report Appendix I at ¶¶7-18. If anything, this makes my analysis conservative: If Dr. Tucker were correct that Google's marginal costs are "[redacted]," Tucker Report ¶402, this would imply that Google's economies of scale are not exhausted, such that its marginal cost would be below its average costs.

507. Tucker Report ¶400.

508. Tucker Report ¶404(b).

509. Dr. Tucker asserts incorrectly that the regulatory environment in telecommunications makes AT&T's market share an unsuitable benchmark. Tucker Report Appendix I, ¶21. In fact, my analysis uses AT&T's market

4. The In-App Aftermarket Is A Relevant Antitrust Product Market

227. Dr. Tucker suggests incorrectly that users and developers in the In-App Aftermarket are no more constrained than hotel guests that can "can choose to watch movies on their phone, tablet or PC."[510] This analogy overlooks a few critical aspects of the In-App Aftermarket. *First*, a given app and its In-App content are not always consistently available from other sources. *Second*, even when the App and its In-App content is available on another platform, such as a console, this may require purchasing a console and/or the game. *Third*, even if the consumer were willing to incur these costs, many users, such as commuters who wish to play a game on the go, will not have a perfect substitute for the App and In-App Content on an Android device.

228. My Merits Report used a SSNIP test to confirm that the In-App Aftermarket is a relevant product market.[511] Dr. Tucker's critiques of this SSNIP test are largely repetitive of her critiques of my SSNIP tests for Android App Distribution Market, to which I have responded in Part III.B.3 above.[512] In addition, Dr. Tucker critiques the econometric estimate I employ to model the competitive supply elasticity that Google would face in a more competitive but-for world.[513] I have responded to this critique in Part I.B above.[514]

229. Without citation to any authority, Dr. Tucker claims that my HMTs are flawed due to "the concentration of spending among certain high-value users."[515] According to Dr. Tucker, "an analysis of the potential impacts of an increase in price or a decline in quality of the Google Play store would need to take into account the heterogeneous effects of those changes."[516] Dr. Tucker offers no basis for this claim, or any hint as to how she believes the SSNIP test should or could be performed differently to account for this heterogeneity. There is heterogeneity in a wide range of industries, but this does not mean that standard HMTs cannot be applied to them. In addition, Google's take rate structure is largely uniform and formulaic,[517] regardless of how heterogeneous users and developers may be.

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share in the deregulated long-distance market. Singer Merits Report ¶328. That the long-distance market was deregulated is precisely why economists have applied the Landes-Posner framework to it in published-peer reviewed research. *Id.* n. 750 (citing Simran Kahai, David Kaserman & John Mayo, *Is the "Dominant Firm" Dominant? An Empirical Analysis of AT&T'S Market Power*, 39 JOURNAL OF LAW & ECONOMICS 499-517 (1996)).

510. Tucker Report ¶410.

511. Singer Merits Report ¶151.

512. Tucker Report ¶413.

513. Tucker Report ¶414.

514. Dr. Tucker asserts that the "capacity of digital content providers, especially those that operate in digital platform settings, to increase output is dependent on much different constraints than what land-line telephone operators faced decades ago." Tucker Report, Appendix I, ¶24. If anything, the supply elasticity of digital competitors in the In-App Aftermarket is likely greater than that in the long-distance market, in which physical infrastructure must be installed and expanded to serve more households. *See, e.g.,* Kahai et. al., *supra*, at 508, n. 23. This makes may analysis conservative, because Google would have even less pricing power in the but-for world if it faces a more elastic supply response from rivals.

515. Tucker Report ¶415.

516. Tucker Report ¶415.

517. *See, e.g.,* Singer Class Reply Figures 1-2.

5. Dr. Tucker's Claims On The Relevant Geographic Market Do Not Undermine My Conclusions

230. In my Merits Report, I explained that the relevant geographic market is global excluding China, where the Play Store is blocked. I further explained that (1) it is possible that a hypothetical monopolist in the Android App Distribution Market in the United States alone could profitably exercise market power; but (2) given the global reach of Google's monopoly power and the Challenged Conduct, for purposes of my analysis it is not necessary to limit the geographic market to the United States.[518]

231. Dr. Tucker claims the Google Play Store competes in a narrower geographic market limited to the United States.[519] Dr. Tucker's claim of a narrower geographic market relies on evidence that App stores may be designed for users of a particular country, language, currency, or targeted to users who share particular interests, as well as evidence that rivals such as the ONE Store are local to a specific country (e.g., Korea).[520] This does not change the fact that the Play Store (as well as the Apple App Store) have global reach, as do the Amazon Appstore and the Samsung Galaxy Store. And the fact that these global app stores translate their pages to local languages and show locally popular apps—as highlighted in Dr. Tucker's Figures 33-36—is irrelevant to determining the geographic market for these stores: it is entirely normal for companies competing in global markets to make local modifications to their product, such as how an international airlines will speak the local language and accommodate local dietary preferences. In any case, my conclusions do not hinge on whether the market is worldwide (excluding China) or limited to the U.S.

C. Dr. Tucker's Report Fails To Show That Google Lacks Monopoly Power In The Relevant Markets At Issue

232. Dr. Tucker claims that "at launch, Google's service fees were set taking into account the service fees charged by Apple for digital content transactions."[521] Dr. Tucker also cites Google's and Apple's more recent take rate cuts as evidence against Google's monopoly power.[522] That two firms in similar lines of business, each dominant in their respective relevant markets, would arrive at similar profit-maximizing prices is hardly evidence of competition. Dr. Tucker relies on testimony from Android founder Andy Rubin,[523] who also testified that, when the Play Store chose its 30 percent take rate, it avoided undercutting Apple's take rate because Google did not want to "start a tit for tat" with Apple. This is consistent with my conclusion that Google exercised monopoly power in the Android App Distribution Market.[524]

518. Singer Merits Report ¶¶109-110.
519. Tucker Report §VII.B.
520. Tucker Report ¶420.
521. Tucker Report ¶450.
522. Tucker Report ¶¶463-464.
523. Tucker Report ¶453 (citing Rubin Dep. 59:2:22).
524. Similarly, Dr. Tucker's Table 3 (showing similarity of pricing over time between Google and Apple) is consistent with two dominant firms reaching profit-maximizing prices in their respective markets. Similar logic also applies to Dr. Tucker's Figure 13 (showing similarity of features over time between Google and Apple); this merely provides evidence that the two dominant firm have charged similar quality-adjusted prices.

233. Dr. Tucker claims that monopoly power is absent because the Play Store's take rate has "declined over time."[525] In fact, the Play Store's aggregate take rate has been at or near 30 percent for most of the Class Period, the recent declines in the aggregate take have been modest, and Google's take rate remains far above competitive levels.[526]

234. Dr. Tucker claims that Google lacked monopoly power in the 2008-2009 timeframe when the Play Store's 30 percent take rate was adopted.[527] As I have explained in Part I.A, Google had an advantage at the outset of the Android Market due to its licensing of the Android operating system and its well-established dominance in search and other mobile functionality such as Google Maps.

235. Dr. Tucker claims that there have been improvements in "the services provided by the Google Play store," and that this is evidence against Google's monopoly power.[528] As I have explained in Part II.C.4 above, such trends are the norm for a wide range of tech markets, and this evidence does not undermine my conclusions regarding Google's monopoly power. Dr. Tucker's emphasis on increases in Play Points consumer subsidies over time[529] (relative to a starting level of zero) does not upset my conclusions. Google's aggregate consumer subsidy of [redacted] percent is far below that offered by the Amazon Appstore on third-party devices ([redacted] percent).[530]

236. Like the other Google Experts, Dr. Tucker claims that the Play Store's 30 percent take rate is similar to the rates of other platforms."[531] Dr. Tucker's benchmark take rates do not undermine my conclusions. Dr. Tucker relies on many of the same unsuitable benchmarks (PlayStation, Nintendo, Kindle Direct Publishing, etc.) as the other Google Experts. In Appendix 5, I summarize the various benchmarks offered by each of the Google Experts and I explain why they are unpersuasive.

237. Based on a slide showing take rates for various platforms, Dr. Tucker claims that "Google documents indicate that Google considers the service fees that other app stores charge."[532] Dr. Tucker provides no evidence that this slide influenced Google's pricing in any way. Moreover, the slide highlights the fact that competition has not obligated Google to match Epic's take rate of just 12 percent.

238. Dr. Tucker suggests incorrectly that my analysis "should consider prices on both sides of a two-sided transaction platform like the Google Play store to evaluate monopoly power and competitive effects."[533] In fact, my analysis accounts for pricing to both developers and consumers, as detailed in my Merits Report.[534]

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525. Tucker Report ¶450; ¶456; ¶463.
526. *See, e.g.,* Figure 12, *supra*. Like all of the Google Experts, Dr. Tucker does not consider the possibility that Google's recent take rate cuts may have been implemented in response to anticipated litigation or regulation.
527. Tucker Report ¶47.
528. Tucker Report ¶456.
529. Tucker Report ¶457.
530. Singer Merits Report ¶420.
531. Tucker Report ¶458-460.
532. Tucker Report ¶461.
533. Tucker Report ¶467.
534. Singer Merits Report Part VI.B

239. My Merits Report explained that Google's ability to price discriminate by charging different take rates to certain developers provides additional evidence of Google's market power,[535] as does the fact that Google faces a downward-sloping demand curve.[536] Dr. Tucker acknowledges that the economic literature recognizes that "price discrimination may indicate some degree of market power,"[537] and that "a downward-slopping demand curve[] may indicate some degree of market power,"[538] but claims that this is not the case here. To support these claims, Dr. Tucker cites a paper that presumes "monopolistically competitive markets with modest locational or brand market power" to arrive at her preferred conclusion.[539] A monopolistically competitive market is one in which there are many firms competing to offer similar products to consumers.[540] These conditions do not apply here, as there are not many firms offering App distribution services on Android devices; those that do cannot provide effective competition due to the Challenged Conduct. In addition, Google's market power is hardly locational or modest.

240. Dr. Tucker cites to an additional article to support her claim that "Google's ability to price discriminate is not indicative of monopoly power."[541] This article does not support Dr. Tucker's claim; to the contrary, the authors embrace the standard economic inference that price discrimination cannot exist in the absence of market power. As the authors state in the introduction, economists have recognized for decades that "if there is price discrimination, there must be market power."[542] The authors do not dispute this basic premise and instead focus on exploring the theoretical strength of the correlation between price discrimination and market power, using a simple, abstract, purely theoretical model.[543]

241. Dr. Tucker's Table 12 lists examples of "app stores analyzed by Plaintiffs' expert reports that charge different prices for different types of transactions on their platform;"[544] Dr. Tucker claims that "[e]vidence that firms without monopoly power charge different prices to different consumers illustrates that price discrimination does not by itself indicate monopoly power."[545] Dr. Tucker ignores that price discrimination is defined as charging different prices to different customers for the same product or service.[546] For example, Dr. Tucker ignores that distribution of Microsoft's Xbox console is not the same as distribution through the Microsoft

535. Singer Merits Report ¶165.
536. Singer Merits Report ¶36.
537. Tucker Report ¶480.
538. Tucker Report ¶480.
539. Tucker Report ¶¶480-481, n. 919-920.
540. PINDYK & RUBENFELD, MICROECONOMICS 5th ed. (Prentice-Hall 2001), at 424-427.
541. Tucker Report ¶481, n. 920, citing Preston McAfee et. al., *Does large price discrimination imply great market power?* 92 ECONOMICS LETTERS 360-367 (2006).
542. McAfee et. al., *supra*, at 360 ("In a competitive market, price equals marginal cost. Wherever there is price discrimination, at least one of the prices deviates from the marginal cost. Therefore, if there is price discrimination, there must be market power. While this logic is sound, it has led many policy-makers to believe that price discrimination and market power are strongly positively correlated…") (citations omitted).
543. *Id.*
544. Tucker Report ¶482.
545. Tucker Report ¶482.
546. ROBERT H. FRANK, MICROECONOMICS AND BEHAVIOR, 8th ed. (McGraw-Hill Irwin 2010) 393-395.

Store, and that distribution through a developer's URL is not the same as distribution through an App Store.[547]

242. I explained in my Merits Report that Google lacks sufficient market power to impose an aftermarket tie-in on developers selling physical goods or services (such as Uber).[548] But there are significant differences between the sale of physical goods from a mobile device and the sale of digital goods from a mobile device. For instance, there is no difference between the physical good purchased in an app and the same good purchased on the web or in a physical store; in contrast, Apps regularly do not exist on the mobile web at all, or lack certain capabilities when they do,[549] and cannot be purchased in physical stores. As a result, physical goods sellers and buyers can much more easily substitute purchases of physical goods away from Apps purchased through the Play Store, in response to an attempt by Google to charge supracompetitive prices. That Google is able to profitably impose a 30 percent take rate over one group of developers while charging a take rate of zero to another group is obvious evidence of Google's market power over the first group, in addition to evidence of its market power generally.

243. I explained in my Merits Report how network effects confer market power on the Play Store.[550] Dr. Tucker claims that a Google document is not supportive of this claim because it states that "[o]nce [Amazon has] their own critical mass of users and developers, they'll also benefit from network effects. At that point, it'll become much harder for us to compete."[551] Dr. Tucker is wrong; that the Amazon Appstore has yet to achieve anything beyond a miniscule market share indicates that Amazon has yet to reach the "critical mass" contemplated by the document. If anything, this provides additional evidence of the Play Store's entrenched network advantage. Relatedly, Dr. Tucker cites to literature purportedly showing that network effects for digital products are unlikely to lead to monopoly power.[552] But the evidence in this case shows that once Google developed a large lead in the Android App Distribution Market, it has been difficult or impossible for rivals to compete effectively. That Google reduced the share of its payments to AT&T and [redacted] indicative of the economic significance of network effects in entrenching Google's incumbency advantage.

244. As Dr. Tucker concedes, my Merits Report relied in part on economic literature demonstrating how network effects can enhance and entrench monopoly power.[553] Dr. Tucker claims that these effects can be mitigated when users multi-home: "For example, the fact that a rider or driver can easily multihome across Uber and Lyft means that the platforms have to compete vigorously to attract both riders and drivers."[554] That is a poor economic analogy for the status quo in the presence of Challenged Conduct. Although multihoming may generate competition when users can choose among two side-by-side ride-hailing Apps on their device, each with a

547. Tucker Report Table 12 (listing for the Microsoft Store a "5% commission for non-game and non-Xbox apps when users download an app through a direct URL," and listing for Aptoide a ten percent take rate "for developers distributing apps using their own channels.")

548. Singer Merits Report, n. 77.

549. Singer Merits Report ¶104.

550. Singer Merits Report ¶¶29, 82, 88, 135.

551. Tucker Report ¶49.

552. Tucker Report ¶¶53, 496-99, 509.

553. Tucker Report ¶495.

554. Tucker Report ¶499.

comparable fleet of vehicles and drivers, Google Play Store users have no comparable competitive alternative, particularly outside of Samsung devices. Due to the Challenged Conduct, would-be rival App stores do not offer a comparable quality and quantity of Apps, nor do they have the same reach as the Play Store. Dr. Tucker's claim that "users and developers who use Android and the Google Play store multihome extensively"[555] illustrates the inapplicability of the Uber/Lyft analogy. According to Dr. Tucker, this "extensive multihoming" includes Apple devices, web apps, websites and gaming consoles.[556] Dr. Tucker does not explain how effectively Lyft would compete with Uber if a consumer had to start up his or her Xbox, or purchase a new smartphone, in order to call a Lyft. More generally, she provides no analysis showing that the multihoming she purports to document in this case prevents Google from exercising monopoly power in the relevant markets at issue.

245. Dr. Tucker claims that "localized" competition "can impose a competitive constraint on a successful platform."[557] Yet Dr. Tucker does not establish that any "localized" competition prevents Google from exercising monopoly power in the relevant markets at issue; if such "localized" competition were sufficient to discipline Google's pricing power, then Google would not be able to command a supracompetitive take rate. Dr. Tucker asserts that gaming platforms "make Google vulnerable to having network effects run in a negative direction as a result of 'localized' competition,"[558] but does not demonstrate that this has occurred, or that gaming platforms have prevented Google from obtaining or exercising monopoly power in the relevant markets at issue.

246. Dr. Tucker claims that "Network effects can also lead to negative feedback loops as well as positive feedback loops. This means they lead to instability."[559] Dr. Tucker provides no analysis showing that negative feedback loops exist in the relevant markets at issue, let alone that they have caused "instability." The Play Store's dominant position has been quite stable for the duration of the Class Period, and before it.

247. Dr. Tucker claims incorrectly that the fact that output has increased over time in the Play Store demonstrates the absence of monopoly power.[560] As I have explained in Part II.C.4 above, this claim is incorrect.

248. In my Merits Report I explained that the ability to sustain high profit margins over extended time periods implies an ability to raise prices over competitive levels and therefore provides direct evidence of monopoly power.[561] Although Google has not produced comprehensive financials for Android, internal analyses in Google documents indicate that Google earned substantial margins on its Play Store, with and without considering advertising revenue.[562]

555. Tucker Report ¶499.
556. Tucker Report ¶499.
557. Tucker Report ¶501.
558. Tucker Report ¶508.
559. Tucker Report ¶502.
560. Tucker Report ¶¶516-517.
561. Singer Merits Report ¶83.
562. Singer Merits Report ¶¶83-85.

249. Dr. Tucker claims that "[c]osts reported in the Google Play store P&L statements used by Plaintiffs' expert reports do not capture all the investments made by Google in the wider Android ecosystem to attract users and developers. … It therefore does not make economic sense to analyze the margins on the Google Play store in isolation."[563] In other words, she claims that investments outside of the Play Store should be accounted for in the Play Store financials. This backward-looking perspective is irrelevant given the purpose of my analysis of the P&L statements, which was to measure the *going-forward* margin earned in the Play Store. For similar reasons, my alleged failure to examine Google's R&D costs[564] is irrelevant for the task at hand. Dr. Tucker offers no evidence that Android is not highly profitable; to the contrary, she instead emphasizes Android's success throughout her report,[565] and the available evidence indicates Android generates substantial profits for Google.[566]

250. Dr. Tucker criticizes me for not calculating profit margins separately for the Android App Distribution Market and the In-App Aftermarket. As explained in my Merits Report, the Play Store financials produced by Google aggregate the two markets together.[567] That they are aggregated for purposes of Google's financial recordkeeping does not imply that they are not separate relevant antitrust product markets, as Dr. Tucker incorrectly suggests.[568]

251. Dr. Tucker claims that the Play Store's profit margins are "not informative about whether Google has monopoly power in the relevant markets"[569] because Google sustained "early losses on Android."[570] According to Dr. Tucker, the Play Store's early losses came to approximately $352 million for 2009-2012, after which the Play Store has been profitable.[571] These early losses pale in comparison to the profit that the Play Store has earned since. For example, in 2021 alone, the Play Store's operating profit was $7.3 billion, plus an additional $5.7 billion in revenue from ads that appear in the Play Store, with almost all of those revenues falling to the bottom line.[572] Subtracting Google's $352 million in early operating losses from the Play Store's $[redacted] in operating profit in 2021 would leave the Play Store with operating profit of [redacted], with an operating profit margin of [redacted] percent.[573] This calculation is merely illustrative; the effect would be diluted further if Google's early losses were allocated across multiple years.

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563. Tucker Report ¶531.
564. Tucker Report ¶¶538-39.
565. *See, e.g.,* Tucker Report ¶67.
566. Singer Merits Report ¶¶83-85.
567. Singer Merits Report ¶173.
568. Tucker Report ¶532.
569. Tucker Report ¶536.
570. Tucker Report ¶536.
571. Tucker Report ¶541 ($51.7M + $102.4M + $126M + $72M = $352M).
572. Singer Merits Report ¶138. Google has projected that the Play Store's operating income will grow to $[redacted] billion by 2025. GOOG-PLAY-010371364 at -376.
573. GOOG-PLAY-010801682 (showing 2021 Play Store revenue (excluding ads) of $[redacted], and operating profit $[redacted], for an operating profit margin of [redacted] percent). Subtracting Google's early losses yields an operating profit margin for 2021 of [redacted] percent.

IV. DR. SKINNER FAILS TO UNDERMINE MY CONCLUSIONS

252. Dr. Skinner critiques my calculations of the Play Store's profit because "Google Play internal management P&L data…does not fully reflect the joint and common costs of those Alphabet resources that benefit Google Play[.]."[574] Dr. Skinner's claim is wrong, and would not undermine my conclusion if correct. *First*, the Play Store's P&Ls maintained in the ordinary course and produced by Google reflect cost allocations that Google deemed appropriate to measure the profitability of the Play Store.[575] *Second*, even if Dr. Skinner were correct that the P&Ls do not fully allocate Google Play's costs, Dr. Skinner's assertion that the correct approach would be to "fully reflect" all Android business lines that "benefit Google Play" is incorrect as a matter of economics.[576] The fact that the Play Store benefits from costs shared with other Android businesses means that the Play Store enjoys economies of scope, which allows the Play Store to be more profitable than it could otherwise. Even if the data were available to implement Dr. Skinner's proposed approach, doing so would incorrectly ignore these scope economies. Put differently, the correct focus from an economic perspective is the incremental costs of the Play Store within the broader Android business, and not on the standalone cost that would be incurred by the Play Store in the absence of Android.[577] Analyzing Google Play as a "standalone" business, as Dr. Skinner suggests, would not make sense from an economic perspective. In both the actual and but-for world Google Play is part of Google, and there is no justification to measure Google Play's profit in a hypothetical world where it is not part of Google.

253. Dr. Skinner critiques my calculations of Android's profitability, which used Google's internal lifetime value ("LTV") analyses.[578] Dr. Skinner claims I failed to show that Google's LTV analyses "capture all relevant costs needed to assess Android profitability."[579] But Google's own documents state that its LTV analyses [redacted]"[580] [redacted]. Dr. Skinner emphasizes a disclaimer stating that LTV is a "theoretical construct" and does not "include the complete set of resources/investments required to build the products."[581] But that same disclaimer states that LTV is "built to guide specific decisions,"[582] which indicates that Google views LTV as a meaningful indicator of profitability for at least some purposes. Moreover, none of my conclusions hinge on the exact dollar amounts resulting from Google's LTV analysis. The LTV analysis is simply additional evidence that Android is profitable—consistent with the Google Experts' repeated emphasis on the success of Google specifically and the Android ecosystem generally. Dr. Skinner makes no attempt to contradict the other Google Experts by asserting that Android is not highly profitable,

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574. Skinner Report ¶22.

575. *See, e.g.,* GOOG-PLAY-000416245 (showing "Sales & Marketing Allocations," "G&A Allocations," and others). I understand that Michael Chase's analysis establishes from an accounting perspective that Play's ordinary course P&Ls are the appropriate measure of Google Play's profitability.

576. Skinner Report ¶22.

577. *See, e.g.,* Gerald Faulhaber, *Cross-Subsidy Analysis with More Than Two Services*, 2 J. COMPETITION L. & ECON. 441 (2005). Dr. Skinner's analysis also ignores that Play's costs likely benefit other of Google's businesses on Android.

578. Singer Merits Report ¶¶83-85.

579. Skinner Report ¶24.

580. GOOG-PLAY-004503351.R at -352.R.

581. Skinner Report ¶197.

582. Skinner Report ¶197.

and Google has not produced financials demonstrating that Android is anything other than highly profitable.

254. Finally, Dr. Skinner criticizes assertions that Google's margins are "high" because "the 'alternative' operating margins … implied by Mr. Chase's 'but-for' operating profit and revenue numbers are higher than certain of Google Play's actual historical operating margins."[583] This criticism is divorced from any relevant economic framework. As Dr. Skinner's Table 1 shows, the "but-for" profits calculated by Mr. Chase based on my but-for world parameters are all lower than Google's actual margin in the respective years.[584] That the Play Store may have higher margins in the but-for world in 2021, as compared to the actual world in 2016, simply reflects that not all of the growth in Google's profit margins over time is attributable to the Challenged Conduct. This is in no way inconsistent with my opinions. Moreover, Dr. Skinner's analysis implicitly recognizes that Google would continue to earn a substantial profit in my but-for world.

Conclusion

255. For the foregoing reasons, the conclusions in my prior reports remain unaltered.

* * *

Hal J. Singer, Ph.D.:

Executed on December 23, 2022.

583. Skinner Report ¶162.
584. Skinner Report Table 1.

APPENDIX 1: MATERIALS RELIED UPON

BATES DOCUMENTS

AMZ-GP_00002471, AMZ-GP_00002484, AMZ-GP_00003314, AMZ-GP_00005705, GOOG-PLAY-000005029, GOOG-PLAY-000083999, GOOG-PLAY-000103456.R, GOOG-PLAY-000128863.R , GOOG-PLAY-000272539-699, GOOG-PLAY-000399013, GOOG-PLAY-000416245 , GOOG-PLAY-000416651, GOOG-PLAY-000443763, GOOG-PLAY-000443763.R, GOOG-PLAY-000451508, GOOG-PLAY-000451520, GOOG-PLAY-000463493 , GOOG-PLAY-000565846, GOOG-PLAY-000578247.R, GOOG-PLAY-000620210, GOOG-PLAY-000620638, GOOG-PLAY-000620996 , GOOG-PLAY-000621061-074, GOOG-PLAY-000621075-084 , GOOG-PLAY-000621139-148, GOOG-PLAY-000621177-189, GOOG-PLAY-000791152, GOOG-PLAY-000808464, GOOG-PLAY-000879069 , GOOG-PLAY-001026503, GOOG-PLAY-001090012-027, GOOG-PLAY-001265881, GOOG-PLAY-001388416-429, GOOG-PLAY-001388750-763, GOOG-PLAY-001547487, GOOG-PLAY-001745614, GOOG-PLAY-001745969-981, GOOG-PLAY-002425286 , GOOG-PLAY-003604122, GOOG-PLAY-004235359, GOOG-PLAY-004456799 , GOOG-PLAY-004494430.C, GOOG-PLAY-004503351.R , GOOG-PLAY-004541676, GOOG-PLAY-004694345, GOOG-PLAY-004697790.R, GOOG-PLAY-004708826, GOOG-PLAY-004728095.R, GOOG-PLAY-006367390, GOOG-PLAY-006381392.R, GOOG-PLAY-007203251, GOOG-PLAY-007379918, GOOG-PLAY-007380405, GOOG-PLAY-009261089, GOOG-PLAY-009911757, GOOG-PLAY-010371364 , GOOG-PLAY-010449493, GOOG-PLAY-010801682, GOOG-PLAY-010801683, GOOG-PLAY-011657415-425, GOOG-PLAY-011657425, GOOG-PLAY3-000018260, GOOG-PLAY4-000301527, GOOG-PLAY4-000804641 , GOOG-PLAY4-004260189, GOOG-PLAY4-007852650 , SEA_EPICPRODUCTION_002243,

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APPENDIX 2: DR. LEONARD'S "REAL WORLD EXAMPLES" ADJUSTED FOR INFLATION

APPENDIX TABLE A1: DR. LEONARD'S TABLE 1 USING REAL PRICES
TOP 100 PAID APPS WITH 15 PERCENTAGE POINT TAKE RATE CHANGE (JULY 2020 VS. MAY 2022)

	Total	No Price Change*	Price Increase	Price Decrease
Based on Real List Price	[redacted]			
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real List Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real List Price Change				
% Real List Price Change 2020.07.01 - 2022.05.31				
Based on Real Net Price				
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real Net Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real Net Price Change				
% Real Net Price Change 2020.07.01 - 2022.05.31				

Sources: Leonard Backup; Google Play transactions data; GOOG-PLAY-007203251; GOOG-PLAY3-000018260; FRED, *Consumer Price Index for All Urban Consumers: All Items in U.S. City Average*, *available at* https://fred.stlouisfed.org/series/CPIAUCSL. Prices adjusted for inflation using CPI with base month 7/2020.
*Consistent with Dr. Leonard, I treat any app whose *real* price changes by less than or equal to 1 percent as having "No Price Change". These apps could still have experienced a nominal price increase. For instance, if inflation during a month is 1% and a given app's price rises by 1%, then its nominal price increases by 1% while its real price stays constant at 0%.

APPENDIX TABLE A2: DR. LEONARD'S TABLE 2 USING REAL PRICE
PRICE CHANGES OF THE TOP 100 PAID APPS WITH A SERVICE FEE RATE REDUCTION OF AT LEAST 10 PERCENTAGE POINTS IN JULY 2021 (JULY 2020 VS. MAY 2022)

	Total	No Price Change*	Price Increase	Price Decrease
<u>Based on Real List Price</u>	[redacted]			
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real List Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real List Price Change				
% Real List Price Change 2020.07.01 - 2022.05.31				
<u>Based on Real Net Price</u>				
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real Net Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real Net Price Change				
% Real Net Price Change 2020.07.01 - 2022.05.31				

Sources: See Table A1, *supra*.

APPENDIX TABLE A3: DR. LEONARD'S TABLE 3 USING REAL PRICE CHANGES, TOP 100 PAID APPS (JULY 2020 – JULY 2021 VS. JULY 2021 – MAY 2022)

	Total	No Price Change*	Price Increase	Price Decrease
Based on Real List Price	[redacted]			
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real List Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real List Price Change				
Based on Real Net Price				
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real Net Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real Net Price Change				

Sources: See Table A1, *supra*. Since some of these apps are not recorded in both 7/2020 and 5/2022, I do not include the percentage change between these two months as in my other tables. *Consistent with Dr. Leonard, I treat any app whose *real* price changes by less than or equal to 1 percent as having "No Price Change". These apps could still have experienced a nominal price increase. For instance, if inflation during a month is 1% and a given app's price rises by 1%, then its nominal price increases by 1% while its real price stays constant at 0%.

APPENDIX TABLE A4: DR. LEONARD'S TABLE 4 USING REAL PRICES
PRICE CHANGES OF THE TOP 100 IAPS WITH A FLAT SERVICE FEE RATE REDUCTION OF 15 PERCENTAGE POINTS AFTER JULY 2021
(JULY 2020 VS. MAY 2022)

	Total	No Price Change*	Price Increase	Price Decrease
Based on Real List Price	[redacted]			
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real List Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real List Price Change				
% Real List Price Change 2020.07.01 - 2022.05.31				
Based on Real Net Price				
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real Net Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real Net Price Change				
% Real Net Price Change 2020.07.01 - 2022.05.31				

Sources: See Table A1, *supra*.

APPENDIX TABLE A5: DR. LEONARD'S TABLE 5 USING REAL PRICES
PRICE CHANGES OF THE TOP 100 IAPS WITH A SERVICE FEE RATE REDUCTION OF AT LEAST 10 PERCENTAGE POINTS IN JULY 2021 (JULY 2020 VS. MAY 2022)

	Total	No Price Change*	Price Increase	Price Decrease
Based on Real List Price	[redacted]	[redacted]	[redacted]	[redacted]
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate	[redacted]		[redacted]	[redacted]
2020.07.01 - 2021.06.30		-		
2021.07.01 - 2022.05.31		-		
Average Real List Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30		-		
2021.07.01 - 2022.05.31		-		
% Real List Price Change		-		
% Real List Price Change 2020.07.01 - 2022.05.31		-		
Based on Real Net Price		[redacted]		
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30		-		
2021.07.01 - 2022.05.31		-		
Average Real Net Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30		-		
2021.07.01 - 2022.05.31		-		
% Real Net Price Change		-		
% Real Net Price Change 2020.07.01 - 2022.05.31		-		

Sources: See Table A1, *supra*.

APPENDIX TABLE A6: DR. LEONARD'S "REAL-WORLD EXAMPLES" FOR SUBSCRIPTIONS WITH REAL PRICES; PRICE CHANGES OF THE TOP 100 SUBSCRIPTIONS WITH A FLAT SERVICE FEE RATE REDUCTION OF 15 PERCENTAGE POINTS AFTER JULY 2021
(JULY 2020 VS. MAY 2022)

	Total	No Price Change*	Price Increase	Price Decrease
Based on Real List Price	[redacted]			
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real List Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real List Price Change				
% Real List Price Change 2020.07.01 - 2022.05.31				
Based on Real Net Price				
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real Net Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real Net Price Change				
% Real Net Price Change 2020.07.01 - 2022.05.31				

Sources: Leonard Backup; Google Play transactions data; GOOG-PLAY-007203251; GOOG-PLAY3-000018260; FRED, *Consumer Price Index for All Urban Consumers: All Items in U.S. City Average*, *available at* https://fred.stlouisfed.org/series/CPIAUCSL. Prices adjusted for inflation using CPI with base month 7/2020. *Consistent with Dr. Leonard, I treat any app whose *real* price changes by less than or equal to 1 percent as having "No Price Change". These apps could still have experienced a nominal price increase. For instance, if inflation during a month is 1% and a given app's price rises by 1%, then its nominal price increases by 1% while its real price stays constant at 0%.

APPENDIX TABLE A7: DR. LEONARD'S "REAL-WORLD EXAMPLES" FOR SUBSCRIPTIONS WITH REAL PRICES; PRICE CHANGES OF THE TOP 100 SUBSCRIPTIONS WITH A SERVICE FEE RATE REDUCTION OF AT LEAST 10 PERCENTAGE POINTS IN JULY 2021 (JULY 2020 VS. MAY 2022)

	Total	**No Price Change***	**Price Increase**	**Price Decrease**
<u>Based on Real List Price</u>	[redacted]			
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real List Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real List Price Change				
% Real List Price Change 2020.07.01 - 2022.05.31				
<u>Based on Real Net Price</u>				
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real Net Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real Net Price Change				
% Real Net Price Change 2020.07.01 - 2022.05.31				

Sources: Leonard Backup; Google Play transactions data; GOOG-PLAY-007203251; GOOG-PLAY3-000018260; FRED, *Consumer Price Index for All Urban Consumers: All Items in U.S. City Average*, *available at* https://fred.stlouisfed.org/series/CPIAUCSL. Prices adjusted for inflation using CPI with base month 7/2020. *Consistent with Dr. Leonard, I treat any app whose *real* price changes by less than or equal to 1 percent as having "No Price Change". These apps could still have experienced a nominal price increase. For instance, if inflation during a month is 1% and a given app's price rises by 1%, then its nominal price increases by 1% while its real price stays constant at 0%.

APPENDIX TABLE A8: DR. LEONARD'S "REAL-WORLD EXAMPLES" FOR SUBSCRIPTIONS WITH REAL PRICES; PRICE CHANGES OF THE TOP 100 SUBSCRIPTIONS (JULY 2020 – JULY 2021 VS. JULY 2021 – MAY 2022)

	Total	No Price Change*	Price Increase	Price Decrease
<u>Based on Real List Price</u>	[redacted]			
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real List Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real List Price Change				
<u>Based on Real Net Price</u>				
Count of SKUs				
Consumer Spend ($)				
Consumer Spend (% of the Top 100)				
Average Service Fee Rate				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
Average Real Net Price [Constant July 2020 Dollars]				
2020.07.01 - 2021.06.30				
2021.07.01 - 2022.05.31				
% Real Net Price Change				

Sources: Leonard Backup; Google Play transactions data; GOOG-PLAY-007203251; GOOG-PLAY3-000018260; FRED, *Consumer Price Index for All Urban Consumers: All Items in U.S. City Average*, *available at* https://fred.stlouisfed.org/series/CPIAUCSL. Prices adjusted for inflation using CPI with base month 7/2020. I use the same methodology as Dr. Leonard of including all top 100 apps by consumer expenditure that had at least 1 month occurring in both the pre- and post-rate reduction period. Since some of these apps are not recorded in both 7/2020 and 5/2022, I do not include the percentage change between these two months as in my other tables. *Consistent with Dr. Leonard, I treat any app whose *real* price changes by less than or equal to 1 percent as having "No Price Change". These apps could still have experienced a nominal price increase. For instance, if inflation during a month is 1% and a given app's price rises by 1%, then its nominal price increases by 1% while its real price stays constant at 0%.

APPENDIX 3: LINEAR DEMAND DOES NOT FIT THE DATA WELL

	(1) OLS	(2) IV
	Linear Demand	Linear Demand
App Category	**Price Coefficient**	**Price Coefficient**
Art & Design	[redacted]	
Auto & Vehicles		
Beauty		
Books & Ref		
Business		
Comics		
Communication		
Dating		
Education		
Entertainment		
Events		
Finance		
Food & Drink		
Game		
Health & Fitness		
House & Home		
Library & Demo		
Lifestyle		
Maps & Nav		

	(1) OLS	(2) IV
	Linear Demand	**Linear Demand**
App Category	**Price Coefficient**	**Price Coefficient**
Medical	[redacted]	
Music & Audio		
News & Mag		
Parenting		
Personalization		
Photography		
Productivity		
Shopping		
Social		
Sports		
Tools		
Travel & Local		
Video Players		
Weather		
Includes FE?	Y	Y
Number of FE	[redacted]	
Observations		
R-Squared		

p-values in parentheses. *** *p*<0.01, ** *p*<0.05, * *p*<0.1. Each column reports the price coefficient corresponding to a given Play store category. Columns (1) and (2) report the linear demand price coefficient corresponding to the equation Q = a + bP. Column (2) uses the tax amount as the instrumental variable respectively. Coefficient estimates calculated using a single, fully-interacted regression model allowing coefficients to vary across the 33 Play Store categories. Fixed effects are unique to App name, App subproduct, purchase type (App sale, In-App purchase, subscription), customer state, App category, and year. *p*-values rounded to the third decimal place

APPENDIX 4: TAX-RATE REGRESSIONS COLLAPSED NATIONWIDE

	(1)	**(2)**
Dependent Variable:	*ln(P)*	*ln(P)*
Tax Rate	[redacted]	
Constant		
Includes FE?	Y	Y
Number of FE	[redacted]	
Observations		
R-Squared		

p-values in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Tax rates expressed as percentages. Fixed effects in column (2) are unique to App name, App subproduct, purchase type (App sale, In-App purchase, subscription), and year. Fixed effects in column (1) are the same, except that they are not year-specific. Prices are calculated by dividing total consumer expenditure by the total units sold across all states and territories. I used the natural log of this weighted average price as the dependent variable. The tax rate is calculated by summing taxes paid across all states and territories, dividing it by the sum of consumer expenditure across all states and territories, and then multiplying this result by 100.

APPENDIX 5: FLAWS IN GOOGLE EXPERTS' TAKE RATE BENCHMARKS

256. In my Merits Report, I used standard economic models and empirical methods to estimate the take rate Google would have charged in a more competitive but-for world. I also presented a "non-comprehensive summary of take rates in comparable competitive digital platform environments," which corroborates the but-for take rates from my economic models.[585]

257. The Google Experts offer various flawed benchmarks purporting to demonstrate that the Play Store's 30 percent take rate is procompetitive.[586] The Google Experts' benchmarks do not undermine my conclusions. *First*, they ignore that the take rates of other App stores may be influenced by Google's own anticompetitive 30 percent take rate, as well as by the Apple App Store's 30 percent take rate. This is one of the reasons I used standard economic models rather than benchmarks to estimate the but-for take rate.

258. *Second*, the Google Experts fail to demonstrate that their benchmarks are representative of competition, as opposed to market power. For example, it would not be surprising if Amazon's take rates on the Twitch, Kindle eBook, Prime Direct Video, and Audible audiobook platforms reflected the exercise of substantial market power.[587]

259. *Third*, many of the Google Experts' benchmarks reflect irrelevant or incomplete information. For example, Dr. Gentzkow lists the Amazon Appstore's headline take rate of 30 percent in Exhibit 11 of his report, and suggests that only small developers (with revenue below $1 million) would pay less, but fails to disclose that the Amazon Appstore's effective take rate (net of discounts to developers) is only [redacted] percent, or just [redacted] percent after netting out discounts to consumers.[588] This is the take rate that is listed in Table 7 of my Merits Report; it is confirmed by the court's opinion in Epic v. Apple,[589] as well as financial data produced by Amazon in this case.[590] The Google Experts list the Samsung Galaxy store's headline rate of 30 percent, but cannot

585. Singer Report ¶318; Table 7.

586. Leonard Report Exhibit 17; Gentzkow Report Exhibits 10-11; Tucker Report Table 10 & ¶460.

587. *See, e.g.,* Jim Milliot, *Publishing Leaders Issuing Warning over Amazon's Market Power* (Aug. 18, 2020), https://www.publishersweekly.com/pw/by-topic/industry-news/bookselling/article/84119-publishing-leaders-issuing-warning-over-amazon-s-market-power.html; IBISWorld, Audible Inc. – Company Profile, https://www.ibisworld.com/us/company/audible-inc/428918/ (estimating that Audible accounts for "an estimated 63.4% of total industry revenue"); Stream Scheme, *Twitch Demographic & Growth Statistics [2022 Updated]*, https://www.streamscheme.com/twitch-statistics/ (estimating that Amazon's Twitch has 73% of live streaming market share); Statista, *Share of consumers renting/purchasing movies and TV shows from selected transactional video-on-demand (TVOD) services in the United States and Canada in 4th quarter 2021*, https://www.statista.com/statistics/793037/popular-tvod-services-north-america/ (describing Amazon video as the "most popular transactional video-on-demand service in the United States and Canada as of the fourth quarter of 2021" with two-thirds of respondents stating they used the platform, compared to the second place YouTube Movies and Shows, which was used by 26% of respondents).

588. [redacted]

589. *See Epic v. Apple*, 559 F. Supp. 3d 898, 997 (N.D. Cal. 2021) ("Apple relies on 'headline' rates that Dr. Evans and Dr. Schmalensee agree are frequently negotiated down. For example, the Amazon App Store has a headline rate of 30%, but its effective commission is only 18.1%.").

590. AMZ-GP_00002471 (Morrill Exhibit 1363).

confirm that this was the effective take rate actually paid by all (or almost all) developers.[591] Moreover, the Challenged Conduct has discouraged Samsung from effectively competing with the Play Store.[592]

260. The Google Experts list production and publishing platforms such as Amazon's Kindle Direct Publishing. This platform performs much more than distribution; it offers a range of services to authors, allowing them to design, format, and publish eBooks, paperback books, and hardcover books.[593] These services extend after publication of a book, including a system for Amazon and eBook purchasers to notify the author of quality issues, and to allow the author to correct images, typos, and formatting issues directly in the publishing platform before republishing.[594]

261. In Table 7 of my Merits Report, I listed take rates for Aptoide ranging from ten percent to 25 percent. Dr. Gentzkow claims that the lower end of this range is "misleading" because the ten percent take rate applies only if the user downloads the App using the developer's link.[595] In fact, my Merits Report explained clearly that the lower take rate applies "if the user downloads the App using the developer's own URL."[596] The ten percent take rate is relevant precisely because, unlike the Play Store, Aptoide's published take rate structure lends itself to steering.[597] When introducing Aptoide as a benchmark, I reiterated that the ten percent take rate applies only "in some cases."[598]

262. The Google Experts' benchmarks also include take rates for Chinese App stores. As explained in Part I.D above, the Google Experts do not acknowledge the limits of intellectual property protection and the widespread practice of app scraping in the Chinese ecosystem, which together limit app developers' ability to command more favorable take rates. They also ignore the considerable regulatory burdens and the associated costs for Chinese Apps stores.

263. The Google Experts also list take rates associated with game stores on various gaming consoles, such as Nintendo (Nintendo E-Shop), Xbox (Microsoft Store), and PlayStation (PlayStation Store). Unlike the Play Store, the revenue earned by these platforms from games purchased for their consoles is used to cover the costs of production and distribution of the game

591. Although Samsung did not publicize take rates below the headline rate, record evidence suggests that Samsung [redacted]. *See, e.g.,* SEA_EPICPRODUCTION_002243 -2437.

592. Singer Merits Report Part IV.2.c.

593. *See* Kindle Direct Publishing, "Create a Book," https://kdp.amazon.com/en_US/help/topic/G202172740.

594. *See* Kindle Direct Publishing, "Quality Notifications Dashboard," https://kdp.amazon.com/en_US/help/topic/GWCUU33VBJHFSRYN

595. Gentzkow Report ¶170.

596. Singer Merits Report ¶253 ("In contrast, other App stores allow developers the ability to select their providers of payment systems for purchases of In-App Content at lower take rates than Google imposes. For example, Aptoide imposes a ten percent take rate for purchases of In-App Content *if the user downloads the App using the developer's own URL*.") (emphasis added).

597. Singer Merits Report ¶¶252-253.

598. *Id.* ¶311 ("Aptoide, another App store operating worldwide, assesses a maximum take rate of 25 percent and *in some cases* charges a take rate as low as ten percent.") (emphasis added).

console hardware.[599] In other words, gaming consoles operate under a fundamentally different business model when compared to App stores.

264. The Google Experts also list the Steam PC Store as a benchmark. But as Dr. Gentzkow acknowledges, the take rate drops to [redacted] percent for games with annual revenue above $10 million, and to [redacted] percent for those with annual revenue above $50 million. Moreover, record evidence indicates [redacted][600] This indicates that Steam retains significantly less than 30 percent of the gaming expenditures on its platform. Table A9 below summarizes the flaws and limitations in the various benchmarks offered by the Google Experts.

599. For example, record evidence indicates that Microsoft loses money on the sale of Xbox consoles, while earning a profit from sales of Xbox games. *See* Sean Keane, "Xbox consoles have never turned a profit for Microsoft," CNET (May 7, 2021), https://www.cnet.com/tech/gaming/xbox-consoles-have-never-turned-a-profit-for-microsoft/. Sony also sells its PlayStation 5 consoles at a loss. *See* Steve Dent, "Sony drops PlayStation 5 sales forecast again due to chip shortage," Engadget (Feb. 2, 2022), https://www.engadget.com/sony-ps5-forecast-down-chip-shortages-085523096.html.

600. *See* Barry Elad, "25+ Steam Statistics 2022 Users, Most Played Games, Market Share and Demographics," Enterprise Apps Today (Aug. 15, 2022), https://www.enterpriseappstoday.com/stats/steam-statistics.html.

APPENDIX TABLE A9: FLAWS/LIMITATIONS IN GOOGLE EXPERTS' BENCHMARKS

Expert(s)	Proposed Benchmark	Flaw(s) & Limitation(s)
Leonard, Gentzkow, Tucker	Amazon App Store	Amazon Appstore effective take rate is [redacted] (or [redacted] excluding consumer discounts).
Leonard, Gentzkow, Tucker	Samsung Galaxy Store	Challenged Conduct discouraged Samsung from competing effectively. Google Experts cannot confirm that 30% is effective take rate actually paid by developers .
Leonard, Gentzkow, Tucker	PlayStation Store	Console business model not comparable; revenues support production/distribution of consoles.
Leonard, Gentzkow, Tucker	Nintendo E-Shop/Nintendo Game Store	*Id.*
Leonard, Gentzkow, Tucker	Steam/Valve	Steam revenue [redacted] power.
Leonard, Gentzkow, Tucker	Kindle Direct Publishing	No evidence Amazon lacks market power. Publishing not comparable; performs much more than distribution.
Gentzkow, Tucker	Apple App Store	Apple has substantial market power.
Gentzkow, Tucker	Microsoft Store	Microsoft's Xbox console business model not comparable; revenues support production/distribution of consoles.
Gentzkow, Tucker	Epic Games Store	Epic take rate is only 12%.
Gentzkow, Tucker	Amazon Prime Video Direct	No evidence Amazon lacks market power. Video distribution is a distinct market.
Leonard	Audible-ACX	No evidence Amazon lacks market power in audiobooks; performs much more than audiobook distribution.
Gentzkow	Aptoide	Lower-end (10%) take rate when consumer downloads via developer URL, allowing for developer steering.
Gentzkow	ONE Store	Take rate only 20%.
Gentzkow	Xiaomi GetApps	Google Experts ignore effects of app scraping, lack of IP protection, and regulatory burdens on Chinese App stores; outside relevant geographic market.
Gentzkow	TenCent MyApp	*Id.*
Gentzkow	Oppo Software Store	*Id.*
Gentzkow	Vivo App Store	*Id.*
Gentzkow	Huawei AppGallery	*Id.*
Gentzkow	Audible	No evidence Amazon lacks market power in audiobooks.
Gentzkow	Kobo	No evidence e-book or audiobook publishing is comparable.
Gentzkow	Nook	No evidence e-book publishing is comparable, or that Barnes & Noble lacks market power.
Gentzkow	Roku	Take rate on paid apps and app subscriptions only 20%.
Gentzkow	Twitch	No evidence Amazon lacks market power. Video live streaming is a distinct market.
Tucker	Shutterstock	No evidence Shutterstock lacks market power. Media licensing is a distinct market.
Tucker	Amazon Music	No evidence Amazon lacks market power. Music distribution is a distinct market.
Tucker	Apple iTunes	No evidence Apple lacks market power. Music distribution is a distinct market.

Exhibit E6
Public Redacted Version

EXHIBIT 7

FILED UNDER SEAL

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

-------------------------------------X

IN RE GOOGLE PLAY STORE
ANTITRUST LITIGATION
Case No. 3:21-md-02981-JD

THIS DOCUMENT RELATES TO:
Epic Games Inc. v. Google LLC, et al.,
Case No. 3:20-cv-05671-JD

In Re Google Play Consumer
Antitrust Litigation
Case No. 3:20-cv-05671-JD

In Re Google Play Developer
Antitrust Litigation,
Case No: 3:20-cv-05792-JD

State of Utah, et al., v.
Google LLC, et al.,
Case No: 3:21-cv-05227-JD

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VIDEOTAPE DEPOSITION
HAL SINGER, PH.D.
Thursday, May 12, 2022
9:07 a.m. (EST)

Reported by:
Ryan K. Black, RPR, CLR, Notary Public

Thursday, May 12, 2022

Video Deposition of HAL SINGER, PH.D., taken at the Law Offices of Munger, Tolles & Olson, LLP, 601 Massachusetts Avenue NW Washington, DC, beginning at 9:07 a.m., before Ryan K. Black, a Registered Professional Reporter, Certified Livenote Reporter and Notary Public and for the District of Columbia.

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I N D E X

E X H I B I T S

THE VIDEOGRAPHER: Good morning. We are on the record at 9:07 a.m. on May 12, 2022. This is the video-recorded deposition of Hal Singer taken in the matter of In re: Google Play Store Antitrust Litigation, filed in the United States District Court, Northern District of California, San Francisco Division, Case No. 3:21-MD-02981-JD.

My name is Emmanuel Pezoa, from the firm Veritext Legal Solutions. The court reporter is Ryan Black, from the firm Veritext Legal Solutions.

Will the court re -- court reporter please swear in the witness?

* * *

Whereupon --

HAL JASON SINGER, PH.D.,

called to testify, having been first duly sworn or affirmed, was examined and testified as follows:

* * *

THE REPORTER: And, Counsel, if you want to state your appearances for the record, that would be great.

MR. RAPHAEL: Sure.

Justin Raphael, Munger Tolles & Olson, for the defendants.

MS. GIULIANELLI: Karma Giulianelli, from Bartlit Beck, for the consumer class.

MS. JIANG: Yajing Jiang from Charles River Associates.

MR. RAPHAEL: Is there anyone on the line who wants to introduce themselves?

MS. ERNST: This is Amy Ernst. I'm here with Hausfeld for the plaintiff developers.

THE VIDEOGRAPHER: Thank you. You may proceed.

MR. ZEPP: Eric Zepp here, from Cravath Swaine & Moore, on behalf of Epic Games.

MR. CAVES: I'm Kevin Caves, with Econ One on behalf of the Commercial developers.

EXAMINATION

BY MR. RAPHAEL:

Q. All right. Dr. Singer, will you just state your name for the record?

A. Hal Jason Singer.

Q. And, Dr. Singer, you've been deposed many times; is that right?

A. Yes.

Q. How many times would you say you've been

developers are passing through savings in order to induce customers to switch to the -- and download the app from the developer's website.

So it's not just theory. I mean, obviously, theory is on my side; but I think we have -- we have good evidence to bear as well.

Q. But you would agree that standard economic theory tells us that developers would have incentives to respond to lower service fees by reducing their prices?

A. Correct.

Q. Okay. And standard economics also tells us that competition drives firms to make competitive investments in product quality, right?

A. Yes. I believe that, as I said, that in -- in a but-for world with lower take rates and this new-found cash flow that the developers would enjoy, not all of it is going to go into the pockets of the owners. But -- but some of that will be reinvested and -- and -- and in services and features that -- that make the app a better experience for the user.

Q. Right. So standard economics would give developers an incentive to respond to lower

service fees by reducing prices and improving quality?

A. Correct.

Q. Now, in your reports, do you have any model that will tell the Court or the jury which developer will follow the incentives to improve quality and which developer will follow the incentives to reduce price?

A. Well, I think all developers will reduce price. My opinion on quality is that it would happen at a -- at a general level, but that is not my proof of impact. My proof of impact turns on the price response.

Q. Have you done any analysis to determine whether any developer would improve the -- the quality of their app in a world with reduced service fees?

A. I don't think I've done analysis. I'm -- I'm aware of some testimony, and we'd have to go into my footnotes of developers testifying that they would do something to that effect. But I -- that's more me just citing a developer than -- you know, than doing -- I took your question to mean original analysis, like trying to model the quality dimension. I don't do that.

impression here. It does account for the differentiated nature of the products within the category that it faces. And so the extent that that differentiation is driven in part by quality differences across apps within a category, it does. It does account for it.

But -- but I'm taking your question to mean -- I'm still going back, and I'll just say it again, that I don't have a separate model apart from the model that -- that you're aware of that -- that -- that attempts to measure changes in quality enhancements by apps in a but-for world, you know, absent the restraints.

Q. But, in fact, the model you have regarding the alleged reduction in prices doesn't measure the amount that any developer will invest in quality either, right?

A. It -- so to be careful, it -- it measures -- by -- by taking into account the differentiation among apps in -- in the same category, it takes -- it takes quality into account. But whether or not it -- it seek -- it does not seek to measure changes in quality that would come about from a more competitive landscape.

Q. And -- and it doesn't measure whether any developer would actually invest, or how much they would invest, in improving the quality of their app in the but-for world.

A. I think that's fair. Just to be clear, I don't seek to measure the change in investment and -- and quality in the but-for world.

Q. Now, your analysis of a potential but-for world assumes entry by a rival app store platform that has a comparable number and quality of apps as the Play Store.

A. I -- I don't think I'm ever that explicit in -- in the offerings of the rival. But what I will tell you it -- it turns on, and we're talking about the Rochet-Tirole model, the -- the one in the app distribution market, just to be clear. Is that -- can we -- can we speak to that one? I -- I'm prepared to speak to that one, at least, and to answer this question, 'cause you talked about a rival app store.

Q. Well, does -- do diff -- do different versions of your model assume different rivals in the but-for world?

A. Absolutely. So remember I -- I've -- I've got a model for the app distribution market

traffic to alternative app stores, you looked at what developers did in the actual world.

MS. GIULIANELLI: Objection to form.

THE WITNESS: In part. I -- I look at what developers did or try to do in the actual world. I look at the fact that there's a lawsuit that is largely about the anti-steering rules. I look at the -- the economic literature on steering. Also, just there's economic meaning in -- we -- in the -- the most effective distribution path. You know, when we -- I've done exclusive dealing cases before and we're always focused on what channel got shut out and was it -- was it the most efficient distribution channel? I'm sure you're aware of this.

And -- and I think that being able to communicate to the -- to your customers that there are lower cost alternatives outside of the Play Store. When they're in the Play Store, or when they're in your app, is the most efficient way.

BY MR. RAPHAEL:

Q. Have you estimated the cost of any mechanism for driving traffic to alternative app stores for any developer other than steering?

MS. GIULIANELLI: Ob -- ob -- ob -- objection.

THE WITNESS: I haven't estimated, but I can -- I can tell you that if you go out and buy a billboard on a highway, right, and you -- we could go look at the billboard price, right, but it -- I don't think you need to do an empirical assessment of the traffic generation of a billboard vis-á-vis communicating to your customer within the app while you've got the customer's attention that, Hey, if you go outside and -- and download my app from an alternative store or an alternative -- or consummate the transaction through an alternative processor, there's no doubt that that would be the more potent or effective means of communication.

BY MR. RAPHAEL:

Q. You haven't done any empirical analysis of which method of driving traffic to an alternative app store is most efficient for any developer, correct?

A. I have not sought to estimate the returns to investing in billboards, I have not sought the returns to investing in television advertising for -- for Internet transactions,

and I've not sought to estimate the returns to investing -- oh, I'm trying to think where else you can do it --

Q. Well, you haven't -- you haven't -- you haven't estimated the returns to investing of any kind of advertising for any developer, correct?

A. I think it's fair to say that I have not -- I have not considered the return to these alternative advertising channels. But I also point out that the fact that Google does not fret about the developer advertising there implies that Google was concerned about blocking the most efficient distribution channel. That's what the case is about.

Q. Okay. Now, do you know -- some developers steer in the actual world, correct?

A. Some do. Very few, but, yes, some do.

Q. All right. Have you estimated how -- in your reports how many more developers would have to steer in the but-for world to pressure Google to reduce service fees?

MS. GIULIANELLI: Objection to the form.

THE WITNESS: The -- the model does not require me to come up with the estimate of the amount who would steer, no. Just a sufficient

Android. I took your question to mean for the phone -- for the production of a phone.

Q. Well, isn't the Android operating system an input into the production of the phone?

A. It is. It is an input into the production of the phone, yes.

Q. Okay. So if Google offers OEMs a negative price for And -- the Android operating system in the form of -- or as the -- the -- the revenue-share agreements, wouldn't that be equivalent to a reduction in the marginal cost of producing the phone?

A. I -- I'd -- I'd have to think about that. It's not how I would explain it, you know, to a economics class. Put it that way. I see it as a -- as a source of revenue, not a -- not a -- not a -- not -- not entering the cost function.

Q. Okay. Now, your opinion is that every developer that would have paid lower service fees in the but-for world would have also reduced prices, correct?

A. That's correct.

Q. Okay. And that's what your pass-through formula that you've provided in your report

predicts.
A. Correct.
Q. Okay. And you're aware, aren't you, that developers choose the category for their app when they list it in Google Play?
A. Yes.
Q. Now, in your reports, have you calculated or estimated the marginal cost of supplying an additional app subscription or in-app purchaser for any developer?
A. I haven't estimated the marginal cost, but I have cited record evidence and economic literature establishing that they do, in fact, incur marginal costs. And I -- I also have the opinion that processing payments are marginal cost, and I also have the opinion that the take rate is a marginal cost. So I --
Q. Okay.
A. -- leave it at that.
Q. Okay. So in your reports, though, you haven't calculated or estimated the marginal cost of supplying an additional app subscription or in-app purchase for any developer.
A. No. And the models don't call for that. The -- at least in the short run, all the models

require is that they face a positive marginal cost, and I'm confident they do.

Q. All right. So the pass-through formula you've used in your reports doesn't actually depend on what the marginal cost of the developer is.

MS. GIULIANELLI: Objection.

THE WITNESS: That's fair.

Do you want to -- I think we're an hour and a half in?

MS. GIULIANELLI: You want to --

MR. RAPHAEL: Happy to take a break.

MS. GIULIANELLI: -- a break?

THE WITNESS: Okay. Yes.

THE VIDEOGRAPHER: Please stand by.

We're now off the record. The time is 10:40 a.m.

(Recess taken.)

THE VIDEOGRAPHER: We're now on the record. The time is 10:50 a.m.

BY MR. RAPHAEL:

Q. Dr. Singer, have you put forth any method in your reports to determine what each developer's marginal costs are, other than service fees?

A. Well, other than the service fees and the processing fees, I haven't estimated precisely the marginal costs. But I have studied the issue of whether they do incur other marginal costs, and I've come to the conclusion that they do; and I cite record evidence in economics articles.

Q. And so economics articles would be a good source to determine what the marginal costs for the developers are other than the service fees and transaction fees?

A. For identifying the categories of marginal costs but not to -- not to estimate precisely what -- what it is in, say, percentage terms.

Q. Okay. Now, your opinion is that acquiring an app -- strike that.

Your opinion is that downloading an app and making in-app purchases are separate transactions involving separate products.

A. I wouldn't quite put it that way. I would say that the -- the services that are being offered in the in-app for -- in support of in-app transactions are different. It's a different suite of services than the services being offered

consumer is complete?
A. Certainly not the sales costs. Certainly not the processing fee. Certainly not the take rate.
Q. How about the other costs that you've listed here in your report?
A. It's possible that some of those other marginal costs identified by Ghose and Han would occur subsequent to -- to a particular transaction, --
Q. Okay.
A. -- but could still be considered as variable costs in the sense that they rise with -- with output.
Q. Okay. Could the marginal cost to a developer of supplying an additional in-app purchase vary from developer to developer?
A. Sure.
Q. And could some developers have zero marginal costs for an in-app purchase?
A. No.
Q. Could you go to Page 153 of your report?
A. You must mean my initial report because --
Q. Correct.

A. -- the reply is not -- okay.
Page 153?
Q. Yes, sir.
A. Okay.
Q. Do you see there second from the top there's an article by Avi Goldfarb and Catherine Tucker called "Digital Economics"?
A. Yes.
Q. So that's an article that you've relied on in your report?
A. Yes.
Q. Are you familiar with that article?
A. In part, yes.
Q. Okay. Do you know if that article says anything about what marginal costs might be for a digital good?
A. No. But if it were just a digital good, I think that might be too broad of a category. We're talking about in-app transactions here.
MR. RAPHAEL: I'm going to mark this as Exhibit 335.
(Exhibit No. 335, an article titled Digital Economics by Avi Goldfarb and Catherine Tucker, was introduced electronically.)
THE REPORTER: Here you go, sir.

THE WITNESS: Thanks.
BY MR. RAPHAEL:
Q. Do you see Exhibit 335, Dr. Singer?
A. I do.
Q. And what is it?
A. It -- it appears to be the article that I cited.
Q. That's the "Digital Economics" article by Tucker and Goldfarb?
A. Yes.
Q. And -- and could you go to Page 12 of the article?
A. If you'd let me just -- one second. I'd -- I'd like to just read the abstract quickly.
Q. Would you go to Page 12, please?
A. Hold on one second.
Okay. Page 12.
Okay.
Q. Do you see at -- further down, say, two-thirds of the way down in the left column, there's a header that says, "The replication cost of digital goods is zero"?
A. Yes.
Q. So this article that you relied on in your report says that "The replication costs of

digital goods is zero," correct?
A. Correct.
Q. Now, are you familiar with V-Bucks?
A. Oh. Can I put this to the side?
Q. For now, yes.
A. Yeah.
And I would just note for the record that replication costs and marginal costs are not the same.
Q. Well, how are they different?
A. Oh. What -- what Goldfarb is not taking into consideration here is that to sell the extra unit you have to pay a processing fee. That's a marginal cost.
So it's true that to create the next sword -- the 150th sword doesn't cost any more to replicate that sword, but that doesn't mean there aren't any marginal costs incurred in the transaction.
Q. Understood.
All right. Could some developers have negative marginal costs for in-app purchases?
A. It's hard to -- to fathom that.
Q. What if a developer generates advertising revenue as the result of an in-app

Can you give any examples of marginal costs that would be included in the short run, as you defined it, for a developer but would not be included in the long run, as you define it?
A. Oh, no, no. It doesn't work that way, right?
As you move to the long run, the categories expand. So everything -- every kind of cost that would be considered marginal in the short run, would also be considered marginal or variable in the long run.
Q. Okay. Now, pass-through rates are the ratio of the dollar change in the developer's profit-maximizing price that results from a dollar change in marginal cost.
A. Can I just hear it back just to make sure?
Q. The pass-through rate is a ratio of a dollar change in a developer's profit-maximizing price that results from a dollar change in the developer's marginal cost.
A. I think that that is a fair way to put it, yes.
Q. Okay. And so any formula for the pass-through rate should account for the

relationship between a change in the marginal cost and prices.
A. Not necessarily.
Q. So -- well, I just want to be -- I don't think I'm saying anything controversial. The -- the -- the pass-through rate is trying to measure the relationship between how a marginal cost changes and how a price changes.
A. Correct.
Q. Right. The effect of the change in marginal cost on the price.
A. Correct.
Q. Okay. Now, Google's service fee is what an economist would call "an ad valorem fee," correct?
A. I think that's fair.
Q. And an ad valorem fee is one that is calculated based on a percentage of the price that is charged?
A. Correct.
Q. Okay. And sales taxes often are ad valorem fees as well. They're a percentage of the price?
A. Yes. And as I said earlier, we see changes in sales prices -- in -- in sales taxes

being reflected in the prices of apps in the transaction data.

Q. Right. And your opinion is that Google's service fees, to the extent that they are supercompetitive, is equivalent to an increase in the developer's marginal cost.

A. It can be understood that way, yes.

Q. Right. And in your report, you've modeled the proper economic way to calculate how a profit-maximizing developer would set prices based on marginal costs.

A. I have. And --

Q. Right.

A. -- and, as you know, it depends on the -- the nature of the demand and the demand specification that you assume, right? Each demand specification you assume is going to apply at different pass-through rates.

Q. Right. So could you go to Page 104 of your report, your opening report, please?

A. Sure.

Q. And you'll see this is a continuation of the Paragraph 225 from the previous page.

And you've got a formula there that has "P minus C star divided by P equals one divided

by E sub D."
Do you see that?
A. Yes. That's the classic Lerner markup.
Q. Right. So that's -- that's the proper economic model for how a profit maximizing developer would set prices based on marginal costs, right?
A. That model describes the markup over marginal cost as the function of the elasticity of demand faced by the developer.
Q. Right. And -- and this model on Page 104 of your opening report, that -- that's --
A. So --
Q. -- the correct economic mod -- economic way to model how the change in marginal costs will affect the price that the developer charges.
A. It's the -- it's the way to think about it at -- at a very, very high level of abstraction. But, as you know, to actually estimate the pass-through rate here, I have to make an assumption about the demands curve and -- and -- and the precise nature of demand that a -- the developer faces, right?
Once you --
Q. Understood.

A. -- make a -- once you make that decision, you get these pass-through rules, right? And the pass-through rules -- whether you go linear or logit or -- or constant elasticity -- are going to express pass-through as a function of things that do not include the marginal cost.

Q. Understood. But this formula on Page 104 of your report is the correct economic way to model the relationship between the developer's price and the marginal cost in general?

A. Well, I just want to put that caveat in there. It's the -- it's the -- definitely the way to think about it and why it's in my preamble, right?

But when I go to model the precise amount of pass-through, I have to make an assumption about what kind of demand the developer faces, right? And that -- that puts me to a -- takes me to a pass-through rule that isn't necessarily going to be denominated in terms of costs.

Q. Understood. So -- but -- but this mod -- this economic model you've described in Page 104 of your report, that's generally accepted in

economics.
A. Yes.
Q. Now, if you just look at the cost term there, C star, and the -- the C star in that formula that you have on Page 104 of your report is equal to C divided by one minus T, right?
A. Correct.
Q. And -- and in that -- in that cost term I just described, T is the service fee rate?
A. Correct.
Q. And C is the developer's per-unit marginal cost other than the service fee?
A. Correct. Processing and the like, yes. Any other --
Q. Okay.
A. Any other types of marginal costs.
Q. Okay. And so one input into the generally accepted economic model of how the profit-maximizing developer would set pri -- prices is the marginal costs other than the service fee.
A. For short-run profit maximization, the answer is, yes, that this model, at this high level of ab -- of abstraction, is a function of the marginal cost.

Q. Right. And in terms of how the price is a function of mar -- of --of -- of marginal cost, the -- the -- the formula you've got here on Page 104, in that formula, the effect of a change in the service fee -- let me -- let me put it differently.

The formula you've got on Page 104, the effect on prices will be -- as a result of a change in the service fee will be proportional to the marginal costs other than the service fee.

A. In -- for short-run profit maximization, yes. For -- for long-run profit maximization, this is not -- this is not the -- the way that you'd get to the effect on price.

Q. Okay. Now, -- so let me just ask, looking at this cost term here, C -- C star, if C in that formula, which is the marginal cost other than the service fee, if that's zero, then the service fee rate will not have any effect on the ultimate price charged according to this model, correct?

A. Let me just say this: It -- it's -- it's never zero in the real world. But -- but if you want me to ask -- answer the hypothetical, counterfactually, if we had -- if we had a zero

marginal cost, then by this model, and this model alone, then in the short run, prices would not adjust to the take rate.

As I explain in my report, there's all sorts of reasons why we would still, even in that extreme and counterfactual assumption, would expect prices to change with the change in the take rate, including from steering, including from having to cover all costs in the long run, --

Q. Okay.

A. -- including from sticky prices.

Q. Okay. Now, let me just ask again, hypothetically, if that term C, which are the marginal costs other than the service fee rate in your formula on Page 104, if that term is negative, then a reduction in the service fee rate will actually lead to an increase in the price that the developer would charge.

A. I haven't done that one yet, but I think you've got the -- the sign correct. If you multiply, in that example, 1.43 by a negative cost, I think that there -- there would be a negative relationship in the short run for this equation.

Remer and Sheu, right?
A. Correct.
Q. Okay. Now, if -- if we could look at -- well, let me just ask you: The article you relied upon for the pass-through formula by Miller, Remer and Sheu that formula using a per-unit tax rather than an ad valorem tax, right?
A. No. It's much more general than that. They are looking at just -- under any logit demand model, they're asking what is the optimal pass-through rule when the firms in -- are competing under the logit model.
Q. Could you go to the -- Paragraph 239 of your report?
A. Sure.
Q. To the bottom of Page 110.
A. Okay.
Q. And do you see there you have a formula that's "M minus Q sub J divided by M"?
A. Yes.
Q. And that's your formula for the pass-through rate, correct?
A. It -- it is the logit formula. I wish I had invented it. But it's the logit formula,

yes.

Q. Right. And that's the formula you've used to calculate pass-through rates in this case.

A. Correct.

Q. And that formula is derived from Equation 6 of the Miller, Remer and Sheu article that you've cited in your report.

A. Correct.

Q. Okay. Now, let me mark as Exhibit 356 the Miller and Sheu article.

(Exhibit No. 336, a document titled Economics Letters - Using cost pass-through to calibrate demand, by Miller, Remer and Sheu, was introduced.)

BY MR. RAPHAEL:

Q. Is Exhibit 356 [sic] the article you've relied on to derive the pass-through rate formula you've used in this case?

A. Yes.

Q. Could you go to Page 452 of that article?

And in the left column just below the header numbered 2, do you see that there's a paragraph that begins, "Now suppose that a

per-unit tax is levied on each product in the model"? Do you see that?
A. Yes.
Q. So the general model of cost pass-through from the article that you relied on for your pass-through rate formula assumes a per-unit tax, correct?
A. Well, this is in a different section. This is in Section 2. I'm looking at Section 3.
Q. Is it your testimony, sir, that the logit demand model in Equation 6 in the Miller, Sheu and Remer article you relied on for your pass-through formula includes an ad valorem tax?
A. There's no -- there's no tax needed. This is what the -- this is what the pass-through rate would be under logit regardless of whether there's a tax.
Q. Sir, my question was whether the formula -- the Equation 6 from the article you relied upon for your pass-through formula in your report assumes an ad valorem tax.
A. No. Equation 6 does not assume an ad valorem tax.
Q. Okay.
A. No, it does not.

incremental cost, we're going to get the pass-through in this model.

Q. Okay. I just want to understand: The Miller article that you relied on for your pass-through formula uses a per-unit tax, correct?

A. I've acknowledged that in a prior section, in Section 2, there is a -- a per-unit tax assumed. Yes, that is --

Q. And --

A. -- correct.

Q. And how about Equation 6 that is derived from that general model, which is the equation you relied on for your pass-through formula? Does that assume a per-unit tax?

A. There's no mention of the per-unit tax in -- in Part 3, so I don't think that a per-unit tax is necessary to solve for this pass-through rate.

Q. Your testimony is that the Equation 6 isn't derived from the general model of pass-through on Page 452?

A. I cannot find the per-unit tax mentioned either in the surrounding text of Part 3 or in the math. Maybe you could point me to it.

Q. Well --
A. I -- I think that the way Equation 6 should be interpreted is how prices change in the logit model given a change in marginal cost, period.
Q. Right. But, sir, you've testified that to the extent that the -- to the extent that the price will change -- strike that.
You've testified that to the extent that the service fee is a change in the marginal cost, it will affect the price of a -- of the transaction proportional to the other marginal costs, correct?
A. In -- in a very general statement of the demand model, that is true. But once you go into -- to the logit, the cost no longer enters into the pass-through formula.
Q. Okay. So let's go -- why don't we go to Table 5 of your report.
A. Okay.
Q. And that's on Page 98 of your opening report.
Now, if you look at the top of the table, this is the actual world, right? And you see that there you have something called "Google

Price," which I think is Google's average service fee across in-app purchase transactions in the actual world, correct?

A. Yes.

Q. And that figure is $[redacted].

A. Correct.

Q. Now you say, "In the but-for world, Google's average service fee will drop to $[redacted] for in-app purchases," right?

A. Correct.

Q. And so the difference there in Google's service fee on average to developers for in-app purchases is $[redacted]?

A. Correct.

Q. So the reduction in the service fee between the actual and but-for world on average that you've calculated for in-app purchases would be $[redacted], correct?

A. Assuming you're doing the [redacted] minus [redacted]?

Q. Right.

A. That's correct, yes.

Q. Okay. Now, that reduction in service fee will affect the price of the transaction that is charged to the consumer proportional to other

marginal costs, correct?
A. I think not in Stage 1 when I do the logit. It's not -- it's no longer going to necessarily be proportional. I think that in Stage 2, when we do a conversion of how we use the pass-through in the Rochet-Tirole model, we are taking into account the proportionality.
Q. Okay. But in -- in -- the -- the way that you've done it here in Table 5 is that you've just taken the pass-through rate of [redacted] percent, which is the average you calculated, and you've just applied that to the entire reduction in service fee that you've calculated, right?
A. I don't understand the question. Sorry.
Q. So, you have consumer savings per transaction of $[redacted], right, for in-app purchases in the but-for world?
A. Oh, yes. Yes.
Q. Okay. So that's just [redacted] percent, which is the pass-through rate that you've calculated on average of the reduction in the service fee of $[redacted], right?
A. Correct.
Q. So your model for how prices will be set in the but-for world for in -- at -- for in-app

purchases just assumes that all of the reduction in service fee will be passed through as a reduction in marginal cost, at least to the extent of the pass-through rate, right?

A. Not all of it. [redacted] percent of it.

Q. Right. But you haven't done anything here to reflect the fact that the affect on the price will be proportional to other marginal costs, correct? You've just taken the pass-through rate of [redacted] percent and applied it to the reduction in service fee.

A. That's correct. For in-app, that is correct.

Q. Okay. And that's reflective of the general pass-through model you've -- you know, you've used to calculate and propose to calculate damages in this case. Table 5 is.

A. Well, for -- for the in-app market, yes. For -- for the treatment in the app distribution market, it's a little more complicated --

Q. Right.

A. -- the way that the pass-through rate enters the calculus.

Q. Right. So just -- and just so we're clear, the -- the method that you've used for

then applied the difference in the pass-through rate from Table 5, you know, you would expect to get the same results.

A. I'm not -- not sure if I'm following. But I -- but I can say that there are other ways that you could go from -- from the -- from the formula in 104, but all of them would require you to make an assumption about the nature of the demand.

Q. Okay. Could you use the formula in Paragraph 225 of your report that's on Page 104 to calculate the change in marginal cost for the developer and then apply the pass-through rate to that?

A. Not really, because it's -- it's difficult to -- to estimate the change in marginal cost from the developer's perspective.

Q. And that's because you don't know the other marginal costs.

A. Cor -- we don't -- we -- we know of their existence, but we -- we don't know what their magnitudes are.

Q. Okay. The formula from Miller, Remer and Sheu that you used to derive your pass-through formula, that's associated with a

Q. Did you calculate them for -- on a de -- developer -- per-developer basis or a per-app basis?
A. It was at the app level.
Q. Okay. And if you'll go to -- again, back to Paragraph 239 with your pass-through rate formula.
A. Okay.
Q. And you have the formula there "M minus Q sub J divided by M," right?
A. Right.
Q. And "M" is the size of the market?
A. Correct.
Q. And "Q sub J" is the number of transactions involving a particular app.
A. Correct.
Q. Okay. And the market here, this term "M," is, essentially, the total number of transactions of apps in the same category as the app whose pass-through rate you're trying to measure.
A. Correct.
Q. And so basically the formula to calculate the pass-through rate for any app that you've put forward is a hundred minus the app

share of all transactions in its category.
A. Fair.
Q. So just by --
A. Over -- careful caveat: Over the course of the class period.
Q. Okay.
A. We're not going to look at it on a daily basis. We're not going to look at like Dr. Burtis. We're not going to look at it on a monthly.
Q. Okay.
A. We're doing it over the -- over the class period, over the database, over the range of data.
Q. Okay. And why do you do it over the class -- whole class period?
A. Because I don't think it makes sense as an economic matter that a firm is going to be updating its -- its prices or its pass-through rates on a daily basis. I think that the appropriate measure passed through. There's, basically, going to be too much volatility in the -- in the share, right? If you literally were to do it down to the nanosecond, you'd be -- you'd be getting different pass-through rates at -- at

period.

BY MR. RAPHAEL:

Q. But the pass-through formula you have would predict changes in the pass-through rate from week to week or month to month if the share changes. Fair?

A. If one were so inclined to measure it on -- on a monthly or nanosecond basis, yes, you could get very strange results.

Q. Okay. Could the formula you've got here, the "M minus Q sub J divided by M," could that be used to calculate pass-through rates in any case where you know the unit market share of an intermediary alleged to have passed on an overcharge?

A. I -- I -- I'd be reluctant to say that the logit model could be applied to any case. I'd want to confirm, first, as I did here, that the logit model does a good job explaining the relationship between prices and shares, as it does here.

So I think you need some empirical foundation before applying the logit model. I think that would be a good -- good practice.

Q. Okay. Have you used the formula that

you used to calculate pass-through in this case to calculate pass-through in any other case?
A. I do not believe I have. In other cases, what I'm typically doing is regressing retail price changes on wholesale price changes.
Q. Okay.
A. And that -- that's just not available here.
Q. All right. To your knowledge, has any economist used the formula you've used to calculate pass-through in this case to calculate pass-through in some other case?
A. I -- I don't -- I don't know enough -- I can't follow how pass-through is calculated in every antitrust case. I can tell you that the logit assumption is one of the most common assumptions that's used in antitrust cases there is.
Q. But --
A. All right?
Q. But you're not aware of this formula being used to calculate pass-through in another case.
A. Oh. Pass-through? Well, the formula is used to calculate price effects from, say,

and straightforward to do. Like, if -- I can't imagine someone saying, "Oh, the linear model gives you 0.5 always, so I'm going to publish a paper and I'm going to show you here's the implied pass-through rate." I don't think that's the kind of thing that a journal would be excited to publish, right?

Q. Well, let me ask it this way: Have you -- have you seen any -- are you aware of any published paper by an economist in a peer-reviewed journal that has used the formula related to logit demand from this Miller article to calculate pass-through in any industry?

A. Just pa -- I'm not. But pass-through just isn't an area where -- empirical-applied pass-through rates? I -- I -- I imagine that the number of publications of -- of implied pass-through rates, or even -- even observed directly pass-through rates, is just not fodder for -- for publication. It's just not -- it's -- it's the kind of thing that an -- that it would be more likely to come up in an antitrust case where the economist has to estimate pass-through.

Q. Right. But you haven't -- you're just not aware of any article where an economist has

done that in a -- in a peer-reviewed piece.
A. I'm not -- I'm not aware of it, no.
Q. Okay. Now, you would agree that the pass-through rate is going to depend on the shape of the demand curve.
A. Sure.
Q. And the Miller article that you relied on for your pass-through formula has several other formulas for other shape demand curves that you didn't use.
A. I ended up doing a lot of different demand curves. But the one that I ultimately used and relied upon was the logit model.
Q. Okay. And why did you choose the formula from the Miller article that was associated with logit demand?
A. Well, hold on. That was a non sequitur.
I -- once I figured out the logit was the best model at explaining the variation in the data, that took me to the implied pass-through rate from the logit model.
Q. Understood. And what did you do to figure out that the -- let me ask it differently.
Did you -- did you test the structure of demand using any other formula besides the

formula associated with logit demand?

A. Yes.

Q. What other structures of demand did you test?

A. I tested linear and I tested constant elasticity.

Q. Okay. And did you describe those tests in your report?

A. No. Because I ultimately didn't rely on them. The -- they just did not do as -- as good of a job and explain variations in the data as the logit model.

Q. Okay. And then how about the AIDS demand? Did you -- in your reports, did you talk about any test that you did to see whether demand for apps fit that structure of demand?

A. No.

Q. Okay. Why not?

A. I felt that the logit did such a good job at explaining variation, that the way to kick the tires was to try linear and -- and constant elasticity. These are the three, you know, primary models. I'd grant you that A -- the AIDS is also up there, but I felt that I had -- I had run a sufficient test to convince me that -- that

the logit model was giving us the best fit of the data, and it was giving us -- it lent itself -- through Miller it lent itself to pass-through rates that were producing numbers that were reliable and that varied across app categories.

And, you know, and as I said before, logit is a very common system. So I felt very -- I felt very good in -- in using it.

Q. Right. But you haven't used any -- you haven't used the formula from the AIDS demand from the Miller article that you relied on to calculate pass-through rates.

A. That's true. I have not.

Q. Do you know if that formula would actually solve?

A. I'd have to -- I'd have to employ it to be able to -- to tell you whether or not I could -- I could get im -- implied pass-through rates.

Q. So sitting here today, you don't know one way or the other.

A. I don't.

Q. Okay. Now, logit demand has the independence of relevant alternatives property?

A. Correct.
Q. And the -- sometimes known as the "IIA property"?
A. Correct.
Q. And the IIA property is that substitution between goods in a market with logit demand is proportionate to relative shares in that market?
A. Correct.
Q. Okay. Now, economists, though, have long noted that the IIA property of logit demand is not likely to hold in the real world?
A. No, that's not true. I -- in fact, I cite stuff to the contrary. You might find an economist who said that, but -- but I -- I've cited stuff to the contrary in my report.
Q. And, sir, you rely on an article by Werden and Froeb in your report?
A. Correct.
Q. Okay. Do you know what Werden and Froeb say about what economists have noted about the IIA property?
A. Yes.
Q. Okay. What do they say?
A. I'd have to go back to the report, but

they would land on Microsoft's productivity package would be higher than if they were to land on some obscure package within productivity apps. I mean, it's -- it's very intuitive. It's very natural.

Q. Now, your pass-through formula is based on logit demand.

A. Yes.

Q. And one feature of logit demand is that all goods in the market where demand is being measured are substitutes.

A. I think that's a general -- that is generally the case. That's fine.

Q. Okay. Is it your opinion that all apps in each Google Play app category are substitutes?

A. No. And that's why I invoked this concept of cluster markets. Like, you could -- you could take Microsoft's Excel and Microsoft's Word and ask me if they're substitutes, and I would say at -- at that level, they're not. But -- but when you think about the fact that Microsoft and Google are actually competing with a package of productivity apps, that -- that it would make sense to think of that as something more akin to a cluster market the way that we saw

in the Staples and Office Depot case, that paper clips and a ruler aren't necessarily substitutes; but if the people generally tend to buy those things from the same place, they can belong in the same product market.

Q. So -- but -- but it's not your opinion that all apps in each Google Play app category are substitutes.

A. I just gave an example of Excel and Word as being more -- more of complements, right? But -- but when you think about the -- the cat -- the productivity suite that Google is offering, that -- that's clearly a substitute to what -- what Microsoft is offering in its productivity suite.

Q. Right. So some of the apps in each Google Play category could be complements, correct?

A. They could be.

Q. And some could be substitutes.

A. They could be, yes.

Q. Right. And you haven't put forth a model in your report to determine which apps in each category are complements and which are substitutes?

A. No. And it's not necessary to get the

implied pass-through rate.

Q. Right.

Could you go to Paragraph 78 of your reply report -- well, actually, let me ask you: Are you opining that all apps in each category are part of a cluster market?

A. No. You -- you saw in my report. I'm saying that they don't need to necessarily be a market, a relevant market, for antitrust purposes, and I give you a citation for that.

I think that if you -- if you really wanted to -- if you forced it into that box, which is unnecessary and unnatural, that you could -- you could get there by -- by understanding the categories functioning more like a cluster market.

Q. Right. But you're not actually offering the opinion that all of the apps in each category are part of a cluster market.

A. No. I -- I'm offering the opinion that -- that everything within the category -- that the category definitions from Google define the -- the contours or the arena of competition among apps in that category.

Q. Okay. And, again, let's go to Paragraph

Q. Let me -- let me ask a different question. You haven't calculated what those switching costs are.

A. I haven't calculated it, no.

Q. All right. So you ran a regression in your opening report, correct?

A. Well, I ran so many, I'm not sure which one you're speaking of.

Q. So let me -- fair point.

You ran a set of regressions in your opening report.

A. Yes.

Q. Okay. Now, those regressions are testing the elasticity of demand for apps based on a change in the price of the app, right?

A. As instrumented via change in the tax rate, correct.

Q. Okay. Now, the regression you ran in preparing your opening report isn't measuring how a service fee change affects the price of an app or an in-app purchase, right?

A. Correct. We've been through this before. If -- if Google had varied its service fee [redacted], I -- I could have employed a

different model, but I couldn't given the restraint.

Q. Right. So just -- I -- I understand. I just want to make sure we're clear about what your regression does and -- and it doesn't do.

The regressions that you ran in your opening report isn't measuring the effect of the service fee on the price of the app or the in-app purchases, right?

A. Correct. It's doing something close so that I can make a prediction about how a change in the service fee would change the prices.

Q. And you haven't run any regression that measures how a change in the service fee affects the price of an app or in-app purchases?

A. I've -- I haven't -- well, I've tested and -- and analyzed the regressions that were run by Dr. Williams and Burtis that -- that purport to do that or that attempt to do that, but those experiments are so fatally flawed and botched that there is no learning to be done. There's -- there's no -- there's no economic knowledge that can be gleaned from those botched experiments.

Q. Right. Now, the prices that developers charge in the but-for world might depend on

these other dimensions that I just gave you -- you know, consistently downward sloping, statistically significant -- and -- and you're looking for a tie-breaker that -- that at that point comparing the R-squared could make sense.

Q. So you're saying that you ran -- you ran regressions using linear and log-linear demand?

A. Or constant -- we call it "constant" --

Q. "Constant" --

A. -- "elasticity."

Q. "Constant elasticity" demand, and you saw R-squareds that were lower than the R-squared you got for logit?

A. Yes. But I don't want you to think that that was dispositive. That was one of many dimensions over which I made the -- the call.

Q. Right. But the regressions you ran for linear and constant-elasticity demand, those weren't included in the reports or the backup to your reports that you disclosed, right?

A. I did not turn over those regressions, but you can -- your -- your economists can run them for themselves to get confirmation that -- that they don't do as good of a job explaining that data.

that uses a dollar amount of sales tax?

A. Well, in the field -- it's one of the fields in the transaction data that says "taxes", and it -- it is -- it is stated in dollars, I believe, not as percentage. So we get to see what the relationship is between those changes, right, as -- as predictive -- how predictive they are to changes in prices. The fact that they may be denominated in dollars doesn't mean they don't come from ad valorem. I'm pretty confident that they are always -- or that generally -- just to be safe, they're generally set as a percentage of revenues.

Q. Understood. But as you input them into your model regarding the relationship between the sales taxes and the prices, they were in dollar terms and not percentage terms?

A. I believe that's the case. I can -- I can check that out for you in a break, but I believe that the way that it's entered into the database is as dollars.

Q. Got it.

Now, going back to your formula for pass-through, which, again, is essentially a hundred minus the quantity share of the apps

transactions in its category, right?

A. That's for the app developer, but I don't present it that way in the report. I present it, as you know, at the category level.

Q. Understood.

A. Okay.

Q. But that's the general math of the formula?

A. That's the math.

Q. Right. Fair to say that that math will always produce a pass-through rate, unless the app developer or -- has a hundred percent of a Google Play category?

A. I think it's fair that -- that you'll get a positive pass-through rate. You won't necessarily get a big one, but you'll get a positive pass-through rate with the exception of the guy who dominates the field. And, you know, again, this is -- hopefully this is intuitive to the non-economist in that -- in that your share is capturing your dominance in this arena of competition. And so what the logit model is telling us is that the more dominant you are, the less -- the smaller percentage of the pass -- of a cost saving you share with your --

with your client.

Q. Right. But just so we're clear, unless the app has a hundred percent quantity share in the category, your formula will predict a positive pass-through rate?

A. For a given app developer, that -- that is correct, yes.

Q. Okay. Now, you talked earlier about the pass-through formula you have, potentially predicting different rates from month to month or week to week. We talked about that a little bit.

A. Yeah. If you were to measure it on a monthly basis, there would be some variation that you wouldn't get if you were to measure it across the -- the class period. That is correct.

Q. Right. And your opinion is that it's not appropriate to measure it on that short of a time scale, correct?

A. Correct.

Q. Right. And what's the economic basis for why it's inappropriate to measure it on that week to week or month to month or those sorts of time frames?

A. I don't think that an app developer is going to revisit its pricing on a -- on a

Q. And that amount that is passed through as a price deduction is $[redacted] for in-app purchases of price reduction in the but-for world?

A. Correct.

Q. So here you've assumed that the -- for in-app purchases in the but-for world, the -- all of the reduction in Google's service fee is a marginal cost that will affect the price that developers set in the but-for world?

A. Correct.

Q. Now -- and in -- in calculating how prices will be set in the but-for world based on a reduction of this service fee, again, in the in-app purchase context, this calculation doesn't reference the developer's other marginal costs in any way?

A. Correct.

Q. Okay. Now, if you could go to Page -- sorry, again, back to paragraph -- Page 104 of your report with the formula in Paragraph 225, so the -- you have this cost term here C star. Do you see that?

A. Yes.

Q. And that's C, which are the developer's

mean, perhaps that's the percentage, but the dollar amount depends on what the other marginal costs are?

A. Yeah. But you don't need to. That's why I expressed it just as C here. I didn't need to use a dollar for my example. But -- but I can just tell you, we can do the math here, but as you toggle between 30 and 15 percent, the delta on that -- on that coefficient is going to be [redacted] minus [redacted], and that should be understood as a change in percent, right -- change in percentage points of the boosting power of the take rate.

Q. Understood. I just want to -- I just want to be clear because I'm going to -- I want us to just do some math here and see where it goes, --

A. Okay.

Q. -- if you'll follow me.

So the -- if -- if the developers' marginal cost is a dollar and the service fee rate changes from 30 percent to 15 percent, your economic model on Page 104 of your report says that the effective marginal cost will drop by [redacted].

A. If that's the difference of [redacted] and [redacted], sounds right, yeah, times the cost, I think that's fair. Yeah, it's the equivalent of, like, a [redacted].

Q. Okay. But if you go back to Table 5, your -- your calculations for damage purposes say that the reduction in marginal cost is $[redacted], right? On average, right?

A. Correct.

Q. Okay. So what marginal cost of the developer besides the service fees does that $[redacted] reflect?

A. A different one.

Q. Which one?

A. Oh, whatever the -- whatever the unknown marginal cost is to the developers on average. I mean, the beauty of the -- of the logit is that we don't need to estimate the marginal costs in order to get to the pass-through rate. But there is a marginal cost going on in the background, as the math simplifies when you saw for the pass-through rate, such that you don't need to know what it is.

Q. Right. So the logit model in the formula you've used does not depend in any way on

what the other developer's marginal cost is?
A. Not a precise estimate of what it is. Just it depends on the fact, I believe, --
Q. Right.
A. -- that there is a marginal cost.
Q. So -- so let's assume that the average marginal cost of all de -- of all developers was a dollar --
A. Well, why would you assume that when the price here is at [redacted]? Are we going to assume that -- that the margins are that high on average for the developers?
Q. Well, I mean, to be clear, you haven't calculated any of this, right?
A. I didn't need to calculate it.
Q. Okay. And because you didn't need to you didn't?
A. Correct.
Q. Okay. So -- but if it were the case that the average marginal cost for all developers were a dollar, then the average reduction in service -- the average reduction in the effective marginal costs for developers would be [redacted] according to your formula in Paragraph 225 and not $[redacted] that you have in Table 5?

that's being charged for these transactions here. So you're -- you're giving -- you're assuming quite a luxurious margin for the app developer to make that -- that math hold.

Q. Fine, sir. I'm just asking whether, if that were the case, that the math that I'm giving you, that the effective reduction in marginal costs from a 30 percent service fee to a 15 percent service fee for a developer with a dollar marginal cost would be [redacted] cents instead of the $[redacted]?

A. All I'll -- all I'll grant you is that if you go to your equation -- your preferred equation on Page 104 and make the assumptions that you did with a dollar and the move from 30 to 15, the math would suggest [redacted] percentage points of the margin cost. If you assume the margin cost is a dollar, then it would be [redacted].

Q. Right. And so what I'm -- what I'm -- so you agree with me, then, that if you actually calculated the average marginal cost for what -- for a developer on an in-app purchase, it could change the effective marginal cost paid by the increase for the developer in an amount

that's less than the $[redacted] that you have here in Table 5?

A. No, you don't need to do that under the logit model. I will grant you that under Page 104, the generalized equation, that had I used that to estimate my pass-through, that it would depend on the marginal cost. But knowing that I couldn't observe the marginal cost, right, I -- among myriad other reasons that I gave you, I went with the logit model because I didn't need to estimate the marginal cost of the developer.

Q. Right. So you -- so you went with the logit model for pass-through that you used in your report rather than the formula in page -- on Page 104 that depends on marginal costs because you couldn't observe the marginal costs?

A. No. That wasn't the only reason. It was another beneficial property of logit that it doesn't require you to go out and estimate a variable that might be impossible to observe, right? And so -- but that's not -- that's not the only reason or the primary reason why I chose logit. It just happens to be a beneficial property.

Q. Why would the model in Paragraph 225 not

apply to a model of logit demand if the -- if the model in Paragraph 104 is a generic model?
A. Well, because the logit pass-through rule states pass-through as a function of industry concentration and not of cost, and so when you asked me why doesn't -- you're asking me basically why isn't the pass-through rate under logit changing with the change in costs. It doesn't. It's just a property of the logit demand. It doesn't make the math on 104 wrong. It doesn't make the logit wrong. It just -- it's no longer a function of cost.
Q. So the property of the logit demand model that you used for your pass-through is that the price is a function of the concentration and not of the cost?
A. The pass-through is a function of the concentration, not of the cost, correct.
Q. All right. What is focal point pricing?
A. Focal point pricing is the notion that a consumer might focus on the -- on the first digit before the decimal, as opposed to the last two. So it explains why a lot of firms end -- end their prices in 99 cents, or other -- or other combinations. Just a greater focus on the first

-- on the stuff before the decimal place than -- than after the decimal place.

Q. Okay. And do you -- focal point pricing is a well-established concept in economics?

A. Sure.

Q. And in the real world, many developers price transactions only at certain focal points?

MS. GIULIANELLI: Objection.

THE WITNESS: We -- we've -- I've given you all the stats that I think you could ever want to see and more, but, you know, we know that a lot do but a lot don't. You know, 20 percent of the top 200 don't end in 99 cents, right, which is a big number.

BY MR. RAPHAEL:

Q. So fair to say, though, that in the real world some developers price in way that seems like they're focal point pricing and some developers don't?

A. Given -- given the constraints that Google imposed on some developers, yes, they -- you know, they did price at 99 cents.

Q. Well, what analysis have you done, sir, in your reports to determine what effect Google -- any constraints that Google imposed on

BY MR. RAPHAEL:
Q. I guess what I'm asking is, is it your opinion that focal point pricing doesn't explain any developers' pricing in the actual world?
A. No, I think that's too harsh. I think that focal point pricing is an important consideration here.
Q. Okay. Now, and -- and the price floor you talked about of setting prices at 99 cents, that wouldn't affect developers who set their prices quite a bit above 99 cents?
A. That's fair. I think that, when we looked at the data, it's about -- it's about 20 percent of developers were at that 99 cent, so I agree with you that -- that those would be the ones who were constrained from -- from moving downward.
Q. Okay. So the other 80 percent of developers wouldn't be affected by what you're calling the price floor that Google had in place?
A. Correct.
Q. Okay.
A. With one caveat in the sense that there could be spillover effects from a floor being set at 99 on what the next step up would be, but I

out, for the purposes of impact, is to say that if all app developers within a category achieved a certain cost reduction by virtue of enhanced competition and, thereby, lower take rate, how much of that would be shared with consumers in the aggregate across the category. And, you know, what I'm hearing is, oh, my God, have you ruled out 99-cent things or things that end in 9? No, we haven't -- we haven't ruled that out. But we're talking about the share of the costs that are being saved in the aggregate across a category. We can allow for 79-cent pricing, we can allow for 99-cent pricing, 29-cent pricing in the but-for world. We're not putting any restrictions on -- on what the price of a particular app in a particular plan at a particular point in time are.

BY MR. RAPHAEL:

Q. Right. So I just want to make sure I get an answer to my question. So your model for a pass-through isn't trying to take account in any specific way for the phenomenon of focal point pricing?

A. I -- I don't -- I don't think that the mod -- that particular logit estimate of the 89

percent is accounting or needs to take account. I think I need to account for it in my overall opinions about what the but-for world would look like. But the logit model is just telling us what the implied pass-through rate is given a reduction in costs, given the concentration -- the typical concentration we see within categories in -- you know, in the app industry.

Q. Okay. Your regressions regarding the logit demand, did they have any fixed effect or other mechanism to control for focal point pricing?

A. Well, they did use fixed effects. I don't know if you meant to say that, but they don't have a separate control variable for focal point. But it is true, now that you brought this up, we do have app fixed effects, right? So to the extent that an app stayed constant at a given price over time or always ended at 99 -- let me just say for the record what fixed effects is. Quite literally, it's controlling for any of these attributes of the app that are constant over time. And so if that tendency to want to end in 99 or 79 or 69 is constant, then, yes, my regressions control for it.

monopoly power.
Q. Okay. Now, service fees on platforms other than Google Play are marginal costs for developers as well, right?
A. The service fee or the take rate charged by Google to the developer can be understood as a marginal cost.
Q. And when service fees are charged to developers on other platforms that may compete with Google Play, those are also properly understood as marginal costs for the developers?
A. Correct.
Q. Okay. So if we saw service fees on other platforms that are lower than Google Play's service fees, those would be lower marginal costs to those developers. Fair?
A. Fair.
Q. Okay. Now, would you predict, then, that -- well, strike that.
In fact, it's true that many developers do not charge different prices on platforms that compete with Google Play that offer lower service fees.
A. There are examples of that, sure.
Q. And do you know how many developers

record. The time is 2:08 p.m.

(Recess taken.)

THE VIDEOGRAPHER: We're now on the record. The time is 2:10 p.m.

BY MR. RAPHAEL:

Q. Now that you've got your microphone fixed, it's true, according to your report, that some other app stores charge lower service fees for some transactions than Google charges on Google Play?

A. Yes. These -- these diminished competitors, in part by virtue of the challenged conduct, are charging lower, as economic theory would predict they would charge lower. How else would they get someone to switch?

Q. Right. And is it the case that all developers charge lower prices on other app stores that have lower service fees?

MS. GIULIANELLI: Objection.

THE WITNESS: Not all, no.

BY MR. RAPHAEL:

Q. So some developers charge the same price on other app stores than Google Play where there are lower service fees?

A. I would -- I would assume that's a safe

-- yeah, that is a safe assumption that you could find examples of app prices being the same across stores under today's, you know, diminished competition where these rivals aren't really offering meaningful substitution opportunities.

Q. Have you done any analysis in your reports to determine whether the majority of developers on the Google Play store and another app store charged the same or different prices across stores?

A. No, I haven't.

Q. Okay. Now, in your report, I think you note that different PC gaming platforms charge different service fees?

A. Sure.

Q. Right? So Microsoft now charges a 12 percent service fee on -- on PC gaming?

A. Yes.

Q. Okay. And Steam charges more than 12 percent for its PC gaming platform?

A. I think I give the percentages in my report, but I -- I don't recall them being far off from each other. I think it's a more competitive marketplace.

Q. Right. Well, let's go to -- let's

skipped a 2. Let me say it again. 3(d)(2)(c).
BY MR. RAPHAEL:
Q. Okay. We'll come back to that.
A. Okay.
Q. Have you reviewed transcripts of any testimony by any of the developer plaintiffs in this case?
A. Yes. I think I cite some testimony from some developers. I -- I'm not sure if they're plaintiffs in the case, but I -- I recall citing some testimony, at least in my reply, by a developer.
MS. GIULIANELLI: And I -- and I'm just going to keep in mind the expert stipulation with respect to the disclosure of materials relied upon.
BY MR. RAPHAEL:
Q. Okay. So have you relied on any developers' testimony in forming your opinions about how developers would set prices in the but-for world?
A. I don't recall having done that.
Q. Okay. Now, what analysis have you done to determine the extent to which an inability to steer affected developers from reducing prices in

developers.

Q. Right. But other than what's in Table 9, have you done any empirical analysis of the effect on developers' ability or inability to steer on whether they lowered their prices in response to lowered service fees?

A. Other than 9, I -- I don't -- I haven't done one, but what you're asking is a bit of a trick question, which is, in the presence of steering, we -- in the presence of an anti-steering restraint, it is very hard to go out and measure what the effect of steering would be on -- on pass-through or app pricing.

Q. Okay. Now, your opinion is that directing customers from inside the app downloaded from the Play Store to options outside of the Play Store is the most efficient channel for steering?

A. Correct.

Q. Okay. Now, what -- what empirical analysis have you done to support that opinion?

A. Yeah. This has been asked and answered, but I'll -- we'll go back through it again, if you want.

And let me have the question back again,

please.

Q. Have you done any empirical analysis to support your opinion that directing customers from inside the app downloaded from the Play Store to options outside of the Play Store is the most efficient channel for steering?

A. So I think -- I think it's the same answer that I gave you this morning, that I haven't done original empiricism, but I -- I'm aware that Google has not prevented steering on billboards, television advertisements and Internet advertisements, but they have prevented steering from within the app itself once it's downloaded on the Play Store. And that tells me that, to Google, it's the most important channel. Why would Google block it otherwise, right? So I feel like it's a very natural inference for an economist to make that this is the most -- this is the most efficient.

If you -- put it this way: For you to go any other path would incur new costs that you wouldn't otherwise incur by steering within the app store, right? To get someone else's attention on a billboard, you've gotta pay money. You don't need to do that when it's inside of

your own app.

Q. Do you agree that payment systems that require exiting the app to complete the transaction aren't reasonable substitutes for Google Play billing?

MS. GIULIANELLI: Objection.

THE WITNESS: I didn't understand it, so --

BY MR. RAPHAEL:

Q. Are payment systems that would require exiting the app to complete a transaction reasonable substitutes for developers or consumers to using Google Play billing?

MS. GIULIANELLI: Same objection.

THE WITNESS: I don't know if I have an opinion here, and I'm just not aware of any payment processor who requires the customer to leave the app in order to consummate the purchase? I just -- I'm just not aware -- I'm just not aware that that would even -- that is even a thing. I wasn't aware of that.

BY MR. RAPHAEL:

Q. Okay. Is there a term in your pass-through rate formula for the extent to which developers can steer?

A. No.
Q. Why not?
A. Well, as you know, I ultimately chose the logit model, and the logit model's pass-through formula simplifies to a function of market share, which is not a term for steering.
Q. All right. So the -- the logit pass-through formula that you used to calculate the pass-through rates doesn't depend on steering?
A. I would say that steering ensures the pass-through is going to be positive. Logit allows us to estimate precisely what it's going to be.
Q. Okay. So fair to say, then, that the -- the logit model pass-through formula that you've used in your report depends on steering?
A. No, I don't think it depends on steering because we can come up with -- we can come up with explanations for how pass-through would occur in the presence of the anti-steering restraint.
Q. So you -- there's reasons why steering would occur despite the anti-steering restrictions?

A. No, there's reasons why pass-through would occur.

Q. Oh, excuse me. Okay. So there are reasons why -- why you would expect pass-through regardless of the anti-steering restrictions?

A. Correct. I think that while it's true that the anti-steering restrictions make for a very potent impediment to steering and pass-through, there are other ways in which pass-through would occur, even without steering. If I could, you know, Google has modeled different worlds, and so I've kind of mimicked the assumption of where the developer could choose its payment processor, right? And you can imagine a world where developers look around at a whole bunch of payment processors in kind of an open and unfettered market and go with the payment processor offering a competitive rate, or one of the lowest rates, and then competition among developers in the same category would put downward pressure on the prices that they charge to their customers.

So there are -- there are mechanisms that get you to pass-through and lower prices outside of steering. But I'll always hold, until

I'm blue in the face, that steering is like a supercharger. It would -- it would -- it would boost all of these properties.

Q. Have you done any analysis to determine by how much it would supercharge all these properties?

A. No. But -- no. But what I'm assuming, I mean, at least in my -- when I wrote this report, I'm assuming that the challenged conduct is gone, and part of the challenged conduct is the anti-steering restrictions. And so I'm confident that there would be pass-through; that it would be positive. Now the question is, what's the tool in economics that I can use to reliably estimate the extent of the pass-through, and that was the logit model.

Q. Right. Now, Google doesn't restrict any marketing or advertising of other platforms -- strike that.

Google doesn't restrict developers from marketing or advertising transactions on other platforms outside of the app that's been downloaded from Google Play.

A. That's correct. There -- there's -- Google understands that there would be a

newfound cost to be incurred by the developer to advertise in those outside fora, and recognizes that that would be a less-efficient means of communicating, or leading to use Google's word, the customer to a lower-cost platform.

Q. Right. In your reports, have you done any analysis to determine the profitability of steering via any channel, whether in app or outside the app, for any developer?

A. Well, I did -- I give an analysis -- well, I give a numerical example of how steering -- remember, this is the one that begins with the $1.99 price --

Q. Right.

A. -- could improve the profitability of a -- of a developer.

Q. Right. But you haven't done any analysis of using, say, actual data of the profitability of steering in any channel for any developer using actual data?

A. I have, because Table 9 in my initial report shows steering with -- with price reductions. And so, presumably, they wouldn't -- these apps would not be charging a lower price on their website if it weren't profitable to do so.

Q. Well, I'm just saying -- I guess what I'm asking is -- maybe I'll ask it this way: Have -- have you done any analysis that compares the profitability of steering for developers via in app communications versus steering using outside of the app communications?

A. I haven't, but I know this: That to go outside would require a newfound advertising cost that would not otherwise be incurred if you could do it in-app. And that would necessarily lower the profitability of that -- of that steering relative to steering within the app.

Q. Have you done any empirical analysis in your report of whether it would be profitable for any particular developer to reduce prices by a full focal point?

A. I don't know what that means.

Q. Well, --

A. What's a full focal point?

Q. Well, you told me what -- what's your definition of a focal point?

A. Well, we talked about how it's focusing the attention on the left side of the decimal place so you can kind of go high on the right and it's not really going to scare off the customers.

the play points program?

A. The reason why that's the case is that at [redacted] percent or whatever [redacted] offering that Google's making given the impaired competition that it caused, it's not even worth figuring it out. It's like -- it's like asking here's a [redacted], go -- go spend. Like, I don't -- don't bother me, I'm not going to enroll and learn how to use the play points when it's set at [redacted] percent.

Q. My question was in the actual world, it's correct that [redacted]

A. [redacted]

Q. [redacted]

A. I asked the question why bother. [redacted]

Q. [redacted]

[redacted]

A. I can accept that -- that when the -- when the subsidy was at [redacted] percent or whatever [redacted] amount that was offered, that very -- you'd get [redacted] in the program.

Q. So the answer to my question is yes?

A. I can -- I can accept. I haven't studied what percentage redeemed, but when it's so small -- like, imagine instead of a [redacted] it was [redacted] or [redacted], right, and you asked me the question, Hal, why isn't anyone, you know, spending time figuring out how to redeem play points, right? I'd say because we're literally [redacted] purchase. Why would you go through it?

Q. I understand that you think that the [redacted]

A. I can accept that fact. I haven't studied what percentage have.

Q. Okay. So in your reports, you haven't identified any model to determine which

-- the -- the flip, you know, where it occurs, but I can -- I can conceive that [redacted] that it just wouldn't make a difference for consumers.

Q. Okay. Now, in your reports have you identified any model to determine which users would have signed up for play points in the but-for world?

A. No. I don't need to because what the model is giving me is what Google would pay in the aggregate across all consumers in terms of subsidy. So that [redacted] percent that comes out of the play points model, and doing by memory, is what happens in the aggregate. So, it's conceivable that -- that some consumers aren't contributing to that -- to that [redacted] percent or some people are doing it disproportionately, but that is going to be the average subsidy that comes about via the -- that if the locus of competition were to occur on the points side of the market.

Q. So the answer to my question is, no, you -- in your reports you haven't put forth any model to determine which users would have signed up for play points in the but-for world?

A. I don't think I need to, just to be

clear --

Q. I'm not asking you whether you need to.

A. Okay.

Q. So I'm going to ask my question again.

A. Okay.

Q. In your reports, did you put forth any model to determine in the but-for world which users would have signed up for the play points program?

A. That's not what the model is calling for. I'll be clear, the model wants to know -- the model is solving for the size of the subsidy across all consumers, right, and if the model is telling us [redacted] percent, the way to interpret that -- that -- that parameter is that, on average, the subsidy offered to consumers in the but-for world, if the locus of competition were exclusively on the play points side, right, would be [redacted] percent.

Q. Right. And so the model that you put forward in your report regarding play points isn't telling us anything about what individual consumers would do with respect to signing up for the play points program or using their play points, correct?

A. I think the model is. I think that at [redacted] percent, the economic intuition -- well, this is the intuition that I'm drawing from the model -- is that when the benefit gets so large, that is going to spur participation and usage in the system.

Q. Great.

Your -- your testimony here today, sir, is that you have a model in your reports that can tell the Court and the jury in this case which of the members of the putative class would have signed up for play points and who would have used them?

MS. GIULIANELLI: Objection to the form.

THE WITNESS: I didn't say that. I said that if the but-for subsidy were to rise to [redacted] percent, then it would be embraced -- the play points system would be embraced across the class just as the way that the points system in the AMEX marketplace is embraced across American Express users.

BY MR. RAPHAEL:

Q. Okay. So I want to -- I want to be clear. You have -- your testimony is that in the but-for world, every member of the putative class

would sign up for the play points program and use their play points?

MS. GIULIANELLI: Objection.

THE WITNESS: I cannot -- this is the first time I've been asked that question. I'm just hearing it afresh, right? I cannot fathom why a user would say, no, take back -- I was going to spend a hundred dollars and I realize you're trying to give me $[redacted], but, no, I don't want the $[redacted], I want to spend the full hundred myself. It would be crazy -- it would be crazy to -- to do that.

BY MR. RAPHAEL:

Q. Sir, in the actual world, some consumers don't sign up for play points or don't use the play points that they earn, correct?

A. We've established, I hope, that when you get [redacted] back on a hundred dollar purchase, I'd say to myself I'm a busy dude, I don't know if I'm going to sign up for this thing and go through the hassle for the [redacted].

Q. Right. And so your testimony is that if Google changed the play points rate that you've put in your report, that every member of the putative class would have signed up for the play

points program and used play points?
MS. GIULIANELLI: Objection.
THE WITNESS: I think -- I think it's a fair assumption. Like, the model certainly is not calling on this, but I think it's a fair assumption that once it goes up to [redacted] percent that -- that everyone who is making purchases would -- would either redeem it or at least enroll so as to be able -- to be capable of taking the subsidy at -- at those terms.
BY MR. RAPHAEL:
Q. That's an assumption, though, that you're making. It's not what the model tells you?
A. Well, the model spits out, just to be clear, what the average subsidy is across all users.
Q. Now, you -- would you agree with me that the counterfactual experiment lies at the heart of antitrust analysis?
A. Sure. I mean, it's an important thing. It's -- I don't know if it's at the heart, but you need -- you need to have a counterfactual. You need to model the counterfactual.
Q. Could you describe for me the

Q. Right. And, so, therefore, you haven't done that?
A. Correct. Correct.
Q. I just want to be clear that in your model for the but-for world service fee rates, the pass-through rate, the average pass-through rate you've calculated, is an input into that service fee rate model?
A. For the two-sided market model, the -- in the app distribution --
Q. Yes.
A. -- the pass-through rate is input into determining how the optimal take rate in the subsidy model, the subsidy gets chosen, that's correct.
Q. Right. And is that also true for the combined model?
A. That's true for the combined model as well.
Q. And so if the pass-through rate, then -- again, you're not going to agree with this. But if the pass-through rate were zero, okay, that your model for the but-for service fee rate would yield the same rate as in the actual world?
A. I don't know if I've gone in and put

Q. But it's not determinative?
A. I don't think it's determinative. I just think it's helpful and I think that it was worth pointing out, and I gave it about as much attention as it deserves.
Q. So I want to just make sure we're clear. We talked a lot about this formula in Paragraph 224 regarding the profit-maximizing price. This is Page 104 of your report.
A. Yes. You like this formula a lot.
Q. I just want to be clear. Have you used that to -- used that formula to calculate any pass-through rates in this case?
A. No, that was not the formula that I used.
Q. Okay. Now, Google Play has different storefronts for different countries?
A. That's fair.
Q. And now as an economist, why do you think Google offers different storefronts for different countries?
A. Well, Google must think that the differences in the audience is sufficiently important so as to warrant the design of a different storefront. You know, it's expensive

C E R T I F I C A T E

I do hereby certify that I am a Notary Public in good standing, that the aforesaid testimony was taken before me, pursuant to notice, at the time and place indicated; that said deponent was by me duly sworn to tell the truth, the whole truth, and nothing but the truth; that the testimony of said deponent was correctly recorded in machine shorthand by me and thereafter transcribed under my supervision with computer-aided transcription; that the deposition is a true and correct record of the testimony given by the witness; and that I am neither of counsel nor kin to any party in said action, nor interested in the outcome thereof.

WITNESS my hand and official seal this 13th day of May, 2022.

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Notary Public